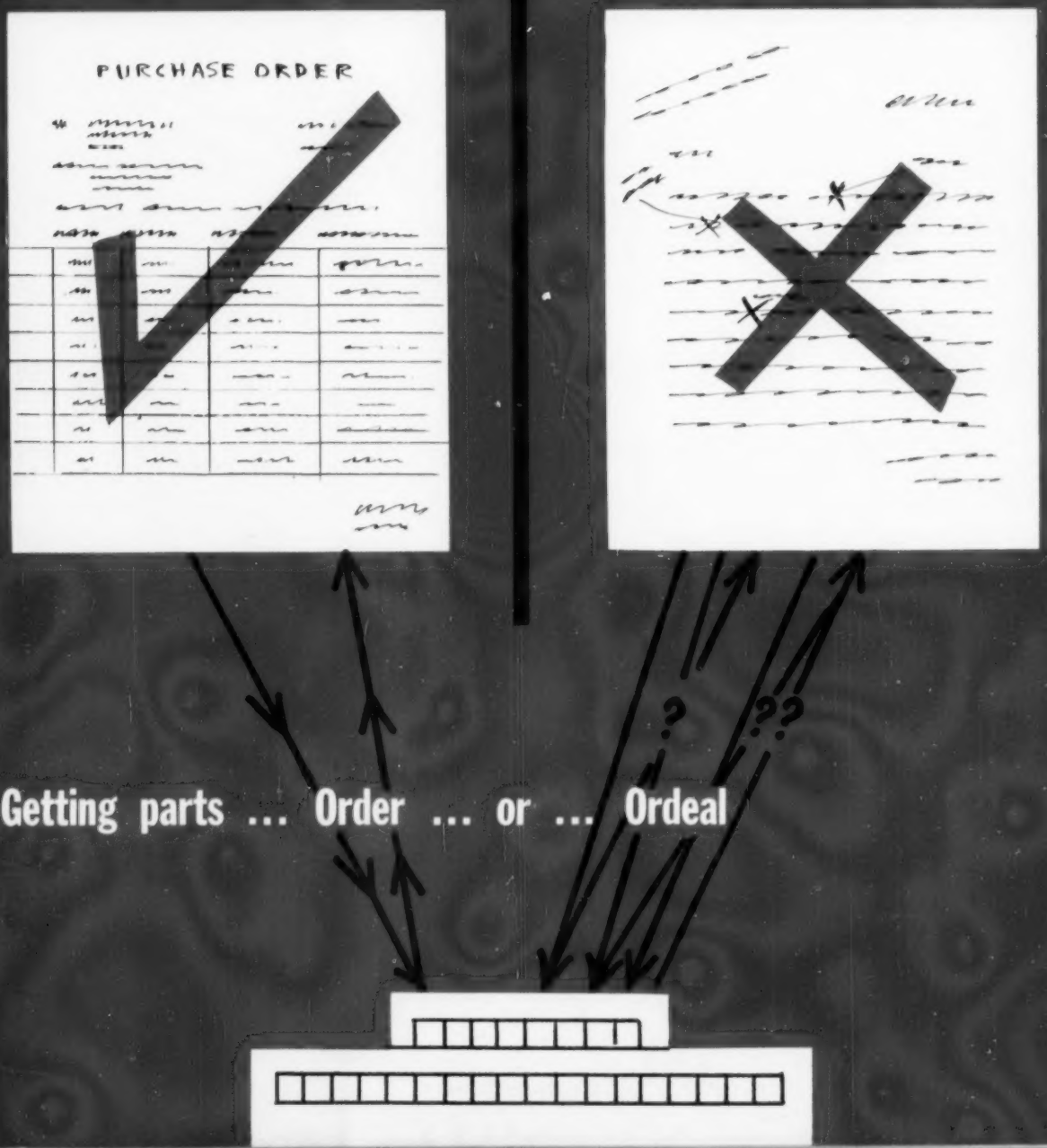
diesel power

May 1956



Getting parts ... Order ... or ... Ordeal

"In perfect condition after 8,550 hours"

—an engine performance report from the Paris, Kentucky, power plant.

Three dual-fuel and two straight diesel engines are in operation at this efficiency-conscious power plant. *Texaco Ursa Oil Heavy Duty* lubricates all these engines—keeps them clean and wear-free; assures smooth, dependable performance. Reports Mr. Zane F. Barnes, Plant Superintendent:

"A scheduled overhaul on one of our dual-fuel engines after 8,550 hours showed rings in excellent shape, wear on liners less than .0005 inch, no evidence of wear on bearings. Check-ups on our other units show substantially the same results—proof that *Texaco Ursa Oil Heavy Duty* is really doing a great job.

"When you combine Texaco's top quality with experienced Texaco Lubrication Engineering Service, you've got a team that assures highest plant efficiency at lowest operating cost."

You'll find outstanding results like these in every plant where Texaco is on the job. There is a complete line of *Texaco Ursa Oils* to meet the requirements of all diesel, gas and dual-fuel engines. And because these world-famous oils consistently assure *more power* with *less fuel* over *longer periods* between overhauls, it is a fact that—

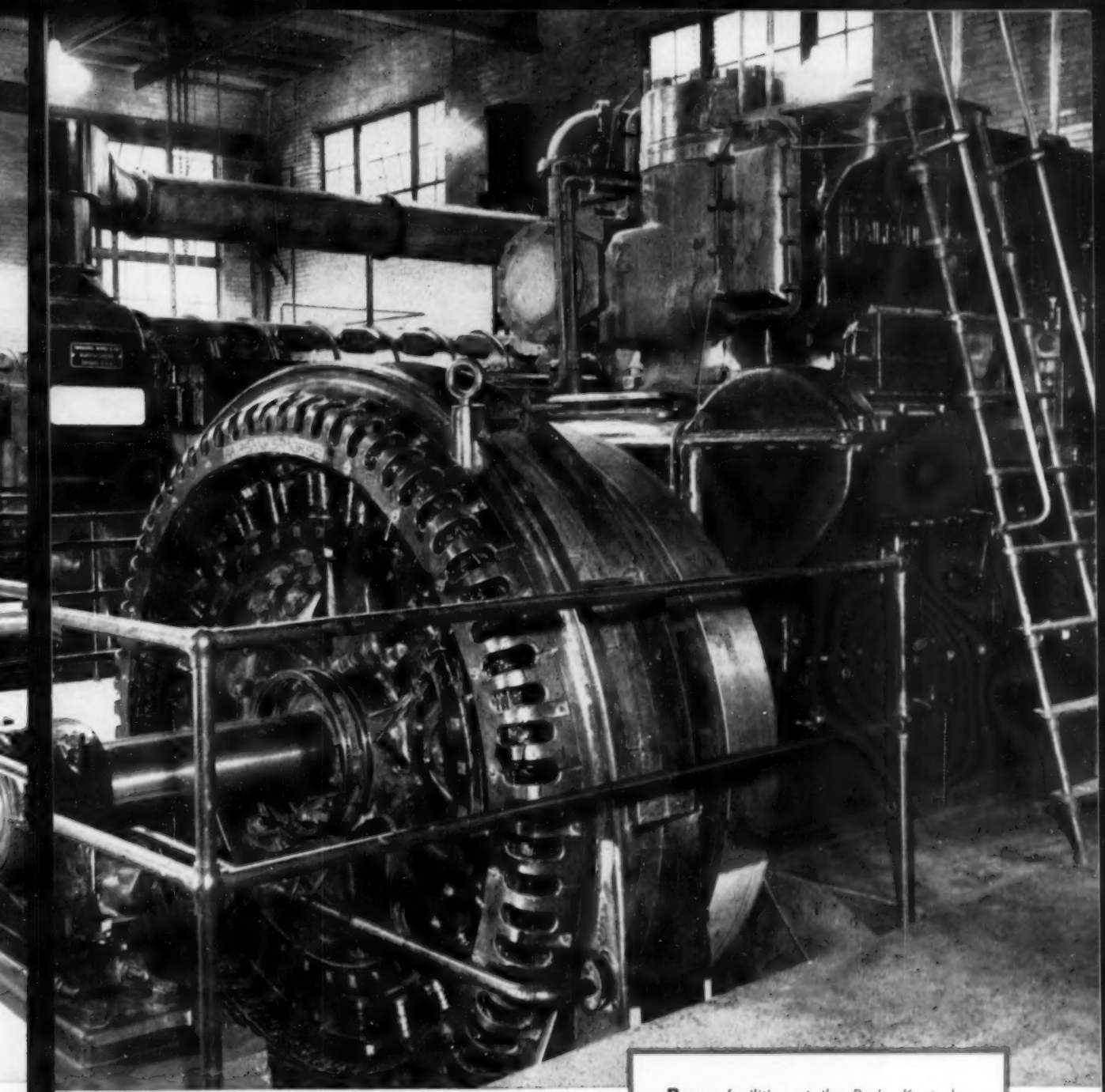
For over 20 years, more stationary diesel h.p. in the U. S. has been lubricated with Texaco than with any other brand.

Let a Texaco Lubrication Engineer help you

TUNE IN:
TEXACO STAR THEATER
starring
JIMMY DURANTE
on television . . .
Saturday nights, NBC.

TEXACO

TEXACO

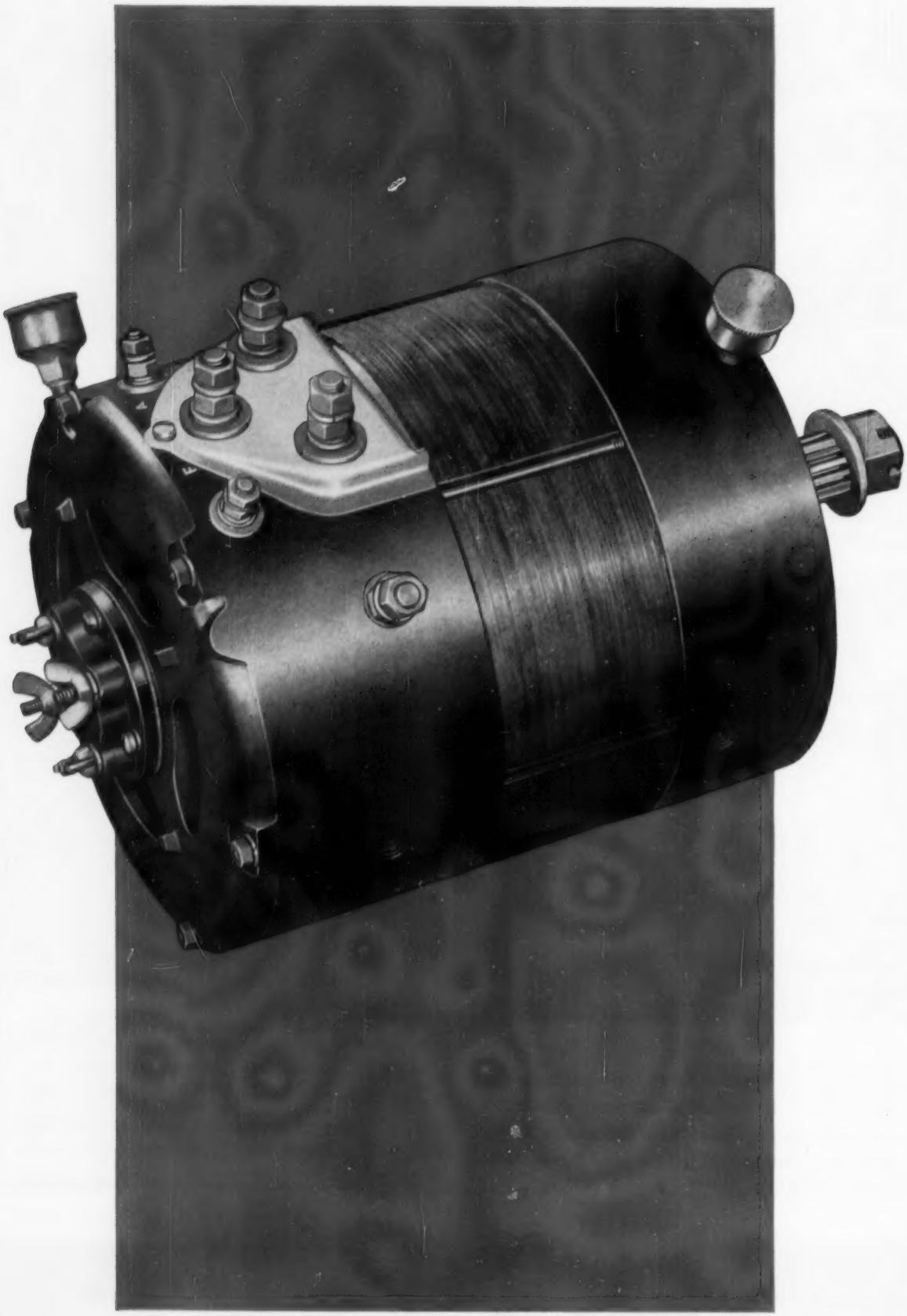


Power facilities at the Paris, Kentucky, plant. Equipment includes: two Fairbanks-Morse 1,920 h.p. dual-fuel engines; one 7-cylinder, 1,400 h.p. dual-fuel; and two Fairbanks-Morse diesels—1,600 and 1,050 h.p. All are lubricated exclusively with *Texaco Ursa Oil Heavy Duty*.

improve engine performance, cut maintenance costs. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, New York.

URSA OILS FOR ALL DIESEL, GAS AND DUAL-FUEL ENGINES



ASK FOR DELCO-REMY MODEL 1117657—THE GENERATOR THAT HANDLES THE TOUGH JOBS—WITH EASE!

This Delco-Remy 12-volt generator—Model 1117657—is the heart of an A.C.-D.C. charging system designed specifically for buses with continuous and extremely heavy electrical loads. It has a low cut-in speed of about 550 rpm, a curb-idle output of 130 amp., and a maximum output of 180 amp. at approximately 2000 rpm. Physically, it is rugged yet extremely low in weight for such a tremendous output. With its matching regulator and rectifier, Model 1117657 will give you all the power a modern bus can use—alternating current for fluorescent lighting, plenty of direct current for other electrical equipment. Specify Delco-Remy A.C.-D.C. charging systems for your buses. They're typical of Delco-Remy leadership in the automotive electrical field.

GM GENERAL MOTORS

GENERAL MOTORS LEADS THE WAY—STARTING WITH

Delco-Remy

ELECTRICAL SYSTEMS

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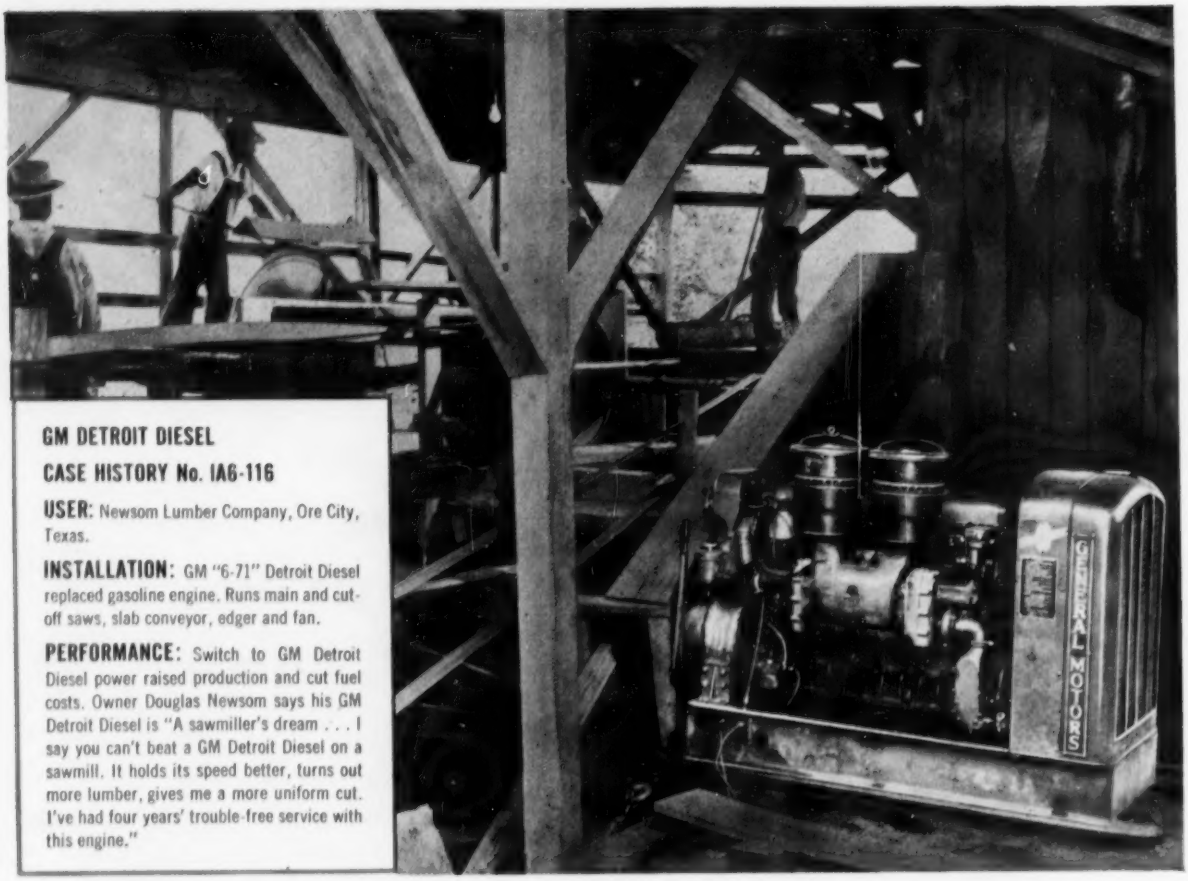

GM DETROIT DIESEL

CASE HISTORY No. IA6-116

USER: Newsom Lumber Company, Ore City, Texas.

INSTALLATION: GM "6-71" Detroit Diesel replaced gasoline engine. Runs main and cut-off saws, slab conveyor, edger and fan.

PERFORMANCE: Switch to GM Detroit Diesel power raised production and cut fuel costs. Owner Douglas Newsom says his GM Detroit Diesel is "A sawmiller's dream . . . I say you can't beat a GM Detroit Diesel on a sawmill. It holds its speed better, turns out more lumber, gives me a more uniform cut. I've had four years' trouble-free service with this engine."

"A SAWMILLER'S DREAM"

HAVE YOU been dreaming of an engine that doesn't slow down when the blade hits knots? That goes *right now* when the load hits the saw? That costs less to buy, run and maintain?

Well, mister, you can stop dreaming because here's the answer to a logger's prayer—a General Motors 2-cycle Detroit Diesel.

It accelerates faster, responds to governor controls quicker, to keep your saw running at its best speed. It starts with a snap even in coldest weather. It's lighter, smaller, more compact than other Diesels of equal power—is about the same size as a gasoline engine with the same rating.

Best of all, it's easy to maintain, does more work on a gallon of fuel, too. And it sells for less than you'd expect to pay for a Diesel. Get all the facts on GM Detroit Diesel power from your distributor or dealer or write direct.

JIMMY DIESEL'S MAINTENANCE TIPS

Keep your GM Detroit Diesel running right—it's easy and it will save you money, too. Check your air cleaners, cooling system, crankcase oil level and filters regularly. And have your GM Detroit Diesel distributor or dealer set up a preventive maintenance program for you. Remember—Preventive Maintenance Doesn't Cost—It Pays.

Jimmy Diesel

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Engine Division
of General Motors
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Single Engines . . . 90 to 800 H.P. *Multiple Units . . . Up to 800 H.P.*

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diesel power

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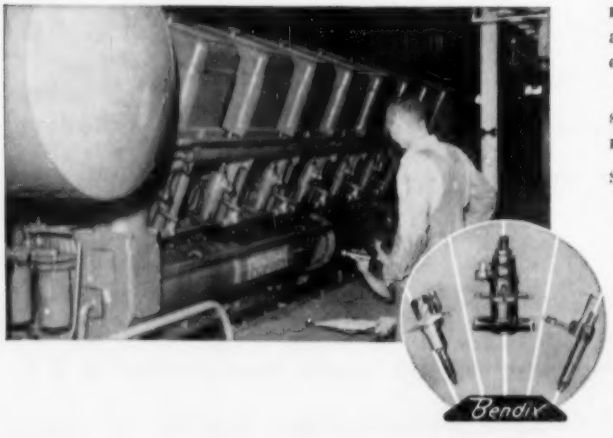
NORDBERG 2800-H. P. DIESEL WITH Bendix INJECTION EQUIPMENT



When the sixteen-year-old dredge "Port Arthur" was modernized with the installation of a new 2800-h.p. Nordberg Supairthermal® V type Diesel with Bendix* fuel injection equipment, a number of very amazing results occurred.

During an early major assignment, pumping production was increased 64 percent. Production per gallon of fuel jumped from 7 to 12.3 cu. yds. per gal., a saving of 75.7 percent. In addition, the new 16 cylinder engine supplies 1050 more horsepower at the pump and provides the Port Arthur with a maximum capacity of 50,000 cubic yards per day.

There is no question about it—efficient, new equipment pays off in a big way. And there is no question about the choice of Bendix injection equipment for dependable, economical operation.

That's why so many leading diesel manufacturers specify Bendix for their fuel injection equipment requirements.

*REG. U. S. PAT. OFF.

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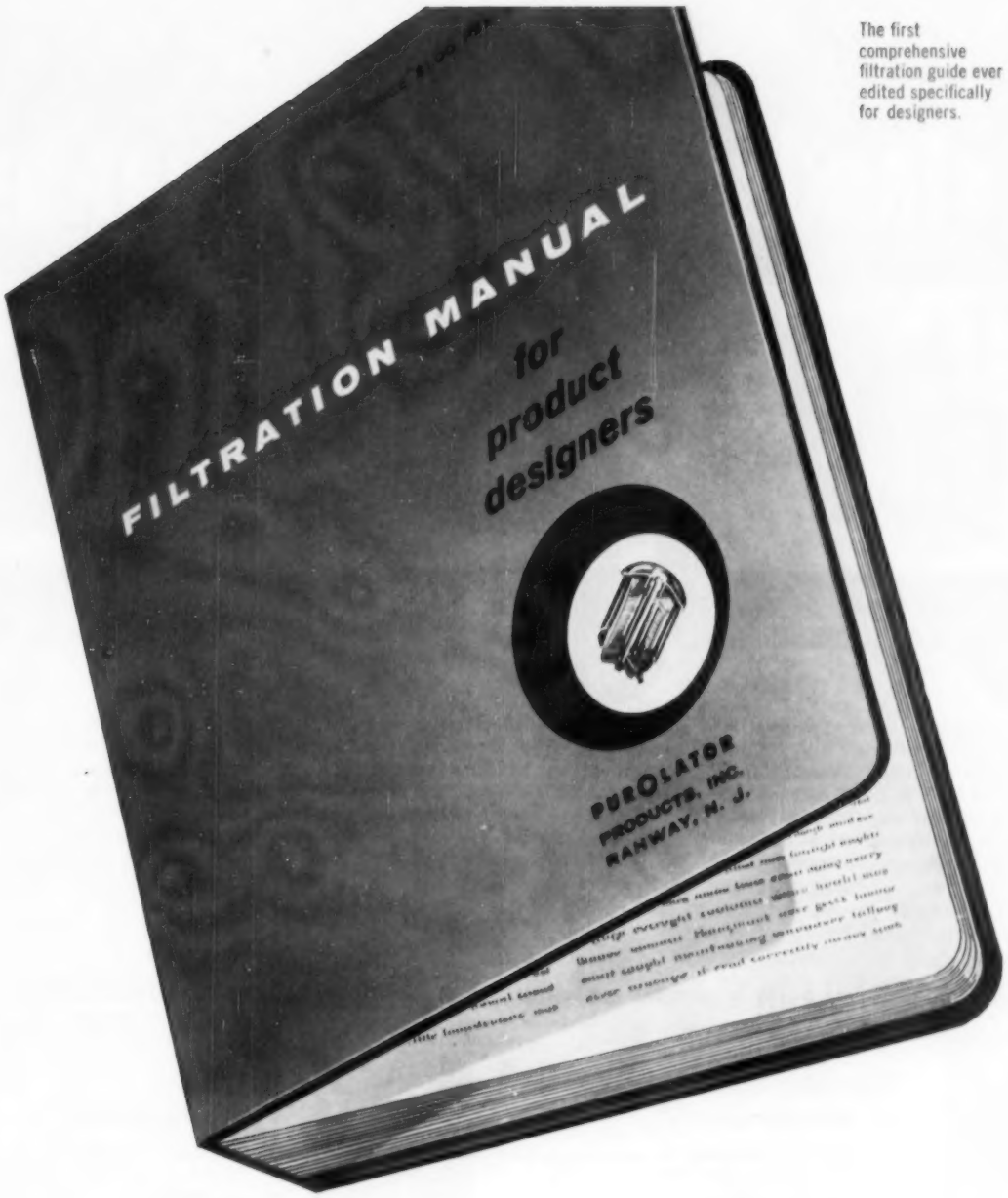

The first comprehensive filtration guide ever edited specifically for designers.

Where are filters used? Why are filters used? How do filters save money? Now for the first time Purolator's new "Filtration Manual for Designers" has all the answers gathered together in one place.

Some typical section headings

- **space requirements**
- **filter costs**
- **selection of type of element**
- **deciding flow capacity needed**
- **economics of filtration**
- **how Micronic® and metal edge filters are made**

"Filtration Manual for Designers" spells out application considerations in detail including degree of filtration, flow rate, contamination to be removed, viscosity of fluid, plus a complete glossary of terms that apply to filtration. Printing of this manual is limited so please send in coupon for your copy today.

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Dept. D8-511 Rahway, N. J.

Please send my copy of your "Filtration Manual for Designers." I'm enclosing 25¢ for postage and handling.

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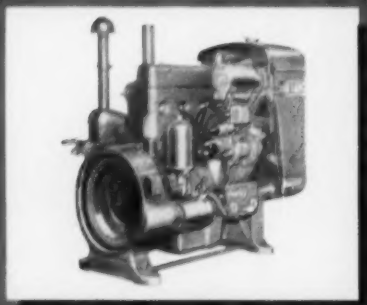
To get the advantages that only 54 years of engine

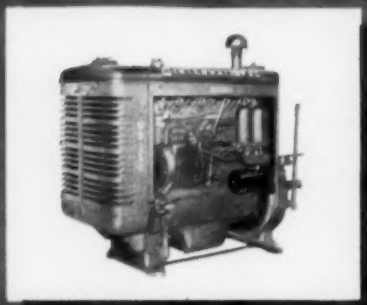
standardize on International

Here are 5 typical members of the International family of 18



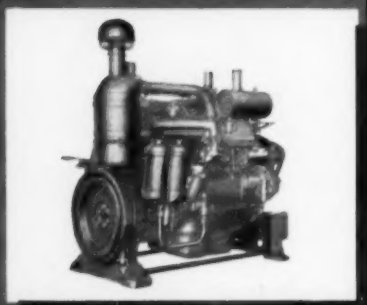
U-169

U-169, rugged 4-cylinder 48.6 hp valve-in-head carbureted unit, delivers top performance on "regular" gasoline. Can be adapted to burn LPG, natural gas, kerosene, or distillate. Ideal for compactors, ⅛-yd excavators, water well drills, fork lifts, rotary snow plows, 12 to 15 kw generators.



UD-350

UD-350, 4-cylinder diesel develops 78.5 bhp as an engine, 75 bhp as a power unit shown above. Available in air compressors, bucket loaders, asphalt mixers and driers, ½-yd shovels and cranes, portable screening plants, 25 to 40 kw generators, hoists, graders, pumps, and trenchers.



UD-525

UD-525, 6-cylinder, 121 bhp diesel with all-weather push-button starting as standard equipment. Available with 14 major attachments, including 43-gal fuel tank, muffler, skid-type subbase. Fits 29 different excavators, graders, compressors, other construction tools.

International power units in various modifications are engineered to team with all these machines:

Shovels, Cranes, Draglines
17 Manufacturers

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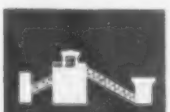
Road Rollers
4 Manufacturers

Asphalt Mixers and Pavers
6 Manufacturers



Crushers
5 Manufacturers

Fork Lifts
3 Manufacturers

Generators
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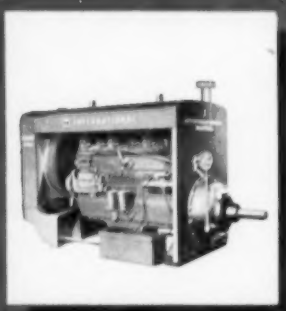
Trenchers
3 Manufacturers

Pumps
12 Manufacturers

leadership can give . . .

Engines

U-450



UD-1091

U-450, one of the most popular 6-cylinder carbureted engines on the market today for trucks, water well drills, 35 to 50 kw generators, graders, ¾-yd shovels and draglines, big rotary snow plows, ditchers and trenchers. Develops 118.5 belt horsepower.

UD-1091, diesel, largest of the 18 International engines, develops 214 bhp, provides exceptional fuel economy for 34 different makes of construction units, including 2 to 2½-yd shovels, 8-cylinder compressors, large asphalt plants and 75 to 100 kw generators.

Engine Model	Displacement (Cubic Inches)	Horsepower (with full equipment less fan)
CARBURETED ENGINES		
U-1	60	17 @ 2500
U-123	123	31.2 @ 2000
U-169	169	48.6 @ 2000
U-264	264	53.5 @ 1600
U-220	220	64 @ 2400
U-240	240	66.5 @ 2400
U-282	282	79 @ 2400
U-372	372	96.5 @ 2200
U-406	406	104 @ 2200
U-450	450	118.5 @ 2200
U-1091	1091	214 @ 1600

Engine Model	Displacement (Cubic Inches)	Horsepower (with full equipment less fan)
DIESEL ENGINES		
UD-264	264	57.5 @ 1800
UD-350	350	78.5 @ 1800
UD-14A	461	100 @ 1800
UD-525	525	121 @ 1800
UD-140-D	525	141 @ 2300
UD-18A	691	131.5 @ 1600
UD-1091	1091	214 @ 1500

In most fields, you'll probably agree, you get the most for your money from the company that's been a leader *for the longest time.*

In engines and power units, the outfit to turn to for longest leadership is International. Since starting manufacture in 1902, International has built and sold *millions of engines* for heavy-duty work! In these 54 years, International has pioneered in developing and perfecting many of the features you consider essential today. Valve-in-head design . . . all-weather diesel starting . . . replaceable cylinder sleeves . . . tocco hardening . . . lubrication through drilled passages . . . precision type bearings . . . full-flow oil filters, to name a few.

These cost-cutting features are backed up with such added advantages as:

Honest horsepower ratings at speeds you can use.

Easy installation with attachments to fit whatever jobs you have.

Fully-experienced sales engineers to help you select and install the engine which best does your work.

Unmatched adaptability, with the same basic engine available as regular or optional power with various modifications in many kinds of equipment (one typical International engine, for instance, fits an International crawler tractor *and 46 makes* of loaders, compressors, asphalt mixers, pavers, excavators, generators, pumps, graders, and rollers). When you power with International, this ready adaptability lessens your parts inventory . . . simplifies and speeds operator training . . . makes your servicing problems a lot easier!

International engine owners get another tremendous benefit, too. To help them is one of the most experienced heavy-duty engine parts and service organizations in the world. At your service are 11 giant regional *parts depots,* 173 Industrial Power *Distributor* locations, *and* hundreds of Power Unit *Dealers.*

To get all these big profit-making advantages, be sure to specify International power. See your nearest Distributor or Dealer for all the facts.

INTERNATIONAL HARVESTER

International Industrial Power

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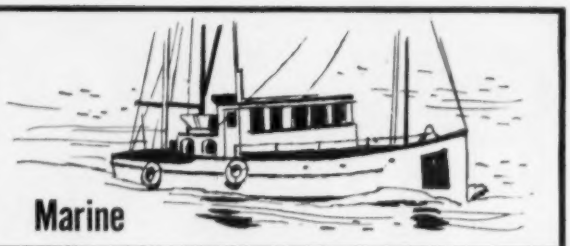
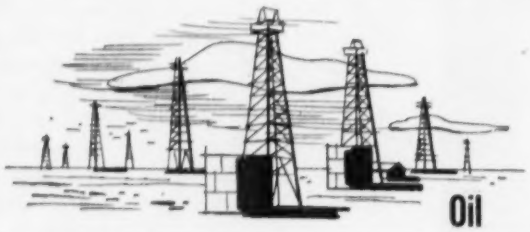
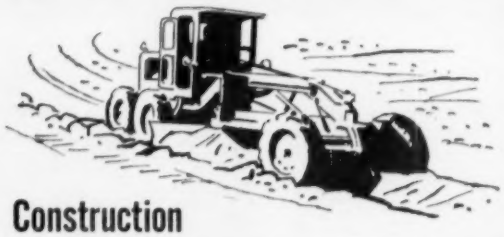
A COMPLETE POWER PACKAGE INCLUDING: Crawler, Wheel, and Pipe-Boom Tractors . . . Self-Propelled Scrapers and Bottom-Dumps . . . Tractor and Rubber-Tired Loaders . . . Diesel and Carbureted Engines

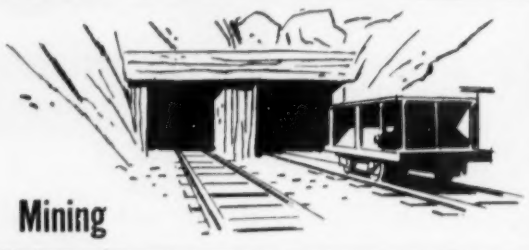
If you're in any of these fields . . .


Marine


Oil


Construction

Agriculture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HAND-CRANKED INERTIA STARTER

This new hand-cranked inertia starter . . . available in four different models . . . is especially suited for use in remote areas and under difficult operating and climatic conditions.

Use the Bendix AE Inertia Starter where shock conditions can damage storage batteries or disrupt voltage regulation. Use it where battery maintenance is a problem or where there is a fire hazard. Mounts in same place as conventional starter on standard S.A.E. 3-bolt flange.

The Bendix AE Inertia Starter is simplicity itself to install. Requires No Cables—No Pumps—No Plumbing. Get full particulars today. BENDIX INTERNATIONAL DIVISION, BENDIX AVIATION CORPORATION, 205 E. 42nd St., New York 17, N. Y., Cable: "Bendixint", N. Y.

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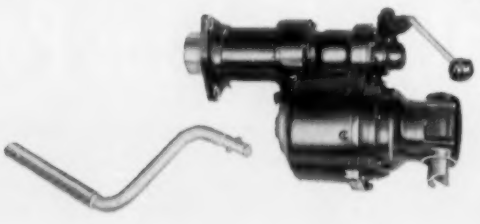


Bendix INTERNATIONAL Product

Bendix AVIATION CORPORATION

A few of the thousands of crankshafts produced at National Forge for new diesel engines.

HAVE YOUR CRANKSHAFTS RECONDITIONED BY A FIRM EXPERIENCED IN MAKING ORIGINAL CRANKSHAFTS

National Forge has been making crankshafts for diesel engines for many years... starting with our own basic electric steel and ending with a shaft ready to install in original equipment, we have a wealth of "know-how" regarding crankshafts.

Recently, National Forge has added a new crankshaft reconditioning division. This includes a large chromium plating department and additional grinding, straightening, and inspection equipment for handling crankshaft reconditioning on a production line basis.

National Forge's large modern facilities and years of experience in producing new crankshafts assure you of proper handling and good workmanship on your reconditioning jobs.

We will be glad to have our field representative call on you to discuss your needs.

NATIONAL FORGE AND ORDNANCE COMPANY

PRODUCES BETTER STEEL FORGINGS AND MACHINE WORK

IRVINE, WARREN COUNTY, PENNSYLVANIA

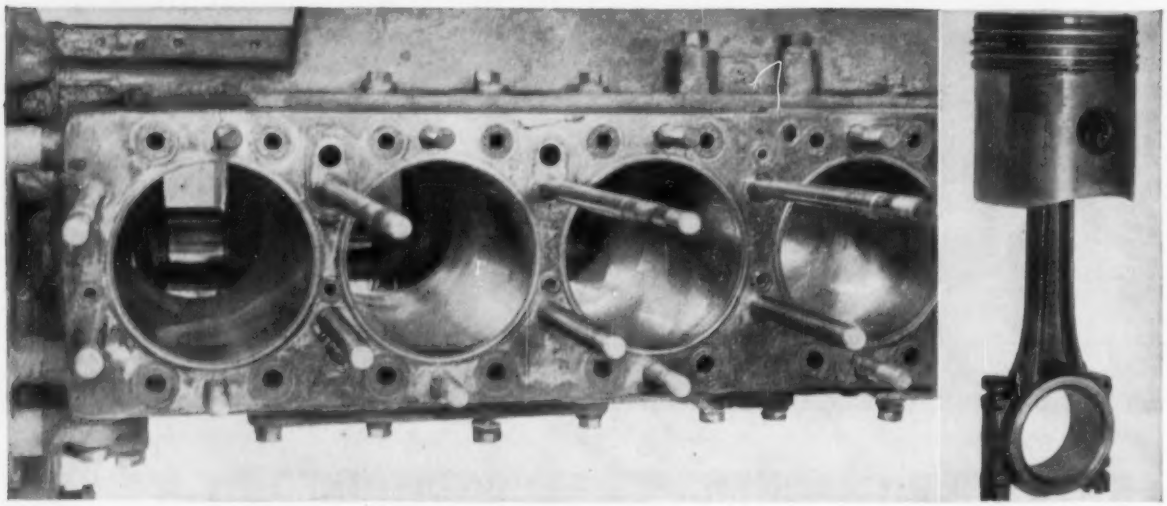
The Engineer's Report

CASE HISTORY

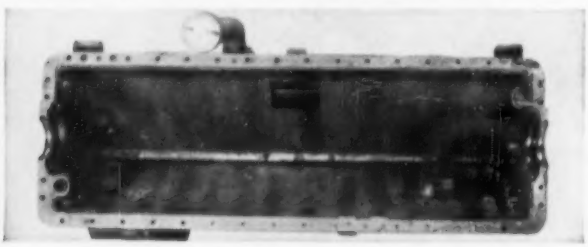
LUBRICANT RPM Delo Oils

FIRM Boise-Winnemucca Stages Inc., Boise, Idaho

Cylinder wear only 0.006″ after 228,413 miles!



USING RPM DELO SPECIAL LUBRICATING OIL, this 180-H.P. Fageol engine went 228,413 miles without repairs of any kind, in a bus owned by Boise-Winnemucca Stages, Inc. It ran in intense summer heat and sub-zero winter temperatures on the line's regular route. Wear on cylinders measured only 0.004" to 0.006" and crankshaft journals were still factory standard. All rings were free, all bearings good and pistons showed no varnish. There was no measurable wear on crankshaft or wrist pins.



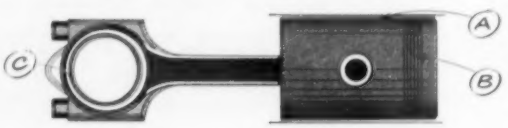
REMOVED FOR FIRST TIME, oil pan shows no deposits, clean metal is visible after draining. RPM DELO Oils reduce wear and keep engines clean in all of the buses owned by Boise-Winnemucca Stages.

FREE FOLDER tells you about all the RPM DELO Oils and how they meet every heavy-duty engine condition. Write or ask for it today.

FOR MORE INFORMATION about petroleum products of any kind or the name of your distributor, write or call any of the companies listed below.

RPM DELO LUBRICATING OILS

How RPM DELO Oils reduce wear, corrosion, oxidation in all heavy-duty engines



A. Contain special additives that provide metal-adhesion qualities...protect parts whether hot or cold, running or idle.

B. Anti-oxidant resists deterioration of oil and formation of lacquer...prevents ring sticking. Detergent keeps parts clean...helps prevent piston scuffing.

C. Special compounds stop corrosion of any bearing metal and foaming in crankcase.

TRADEMARK "RPM DELO" REG. U.S. PAT. OFF.

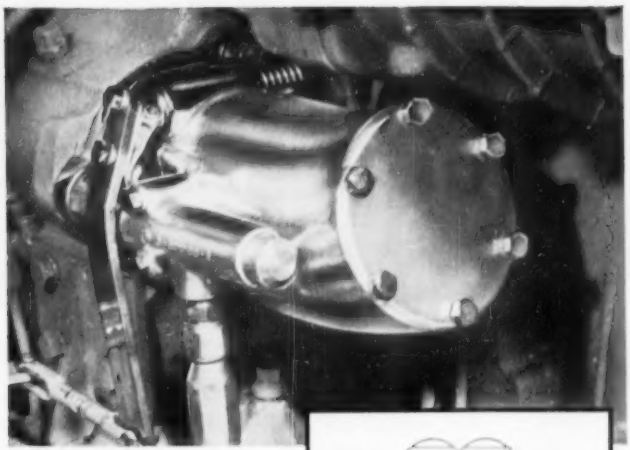
STANDARD OIL COMPANY OF CALIFORNIA, San Francisco 20 • STANDARD OIL COMPANY OF TEXAS, El Paso
THE CALIFORNIA OIL COMPANY, Barber, New Jersey • THE CALIFORNIA COMPANY, Denver 1, Colorado

It takes a power shovel

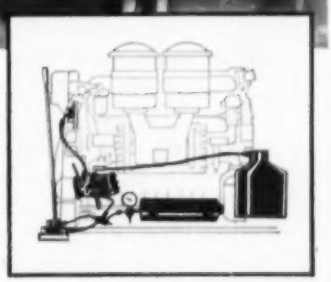
half a second to dump a bucket

But a Hydrostarter starts a GM Detroit Diesel in

One-Third the Time



Heart of the Hydrostarter is this hydraulic starting motor. Other components are an engine-driven pump, accumulator, emergency hand pump and reservoir.



15/100 of a second. That's the split-second it takes a Hydrostarter to start a General Motors Detroit Diesel. And a Hydrostarter cuts your operating costs—costs less to maintain even than regular starting systems. In a recent 26-day test one Hydrostarter started a GM Detroit Diesel 26,788 times. For sure, fast starts even at 20° below zero, specify a Hydrostarter on your next GM Detroit Diesel—or have one installed on your present engine. For more information call your GM Detroit Diesel distributor, dealer or write direct.

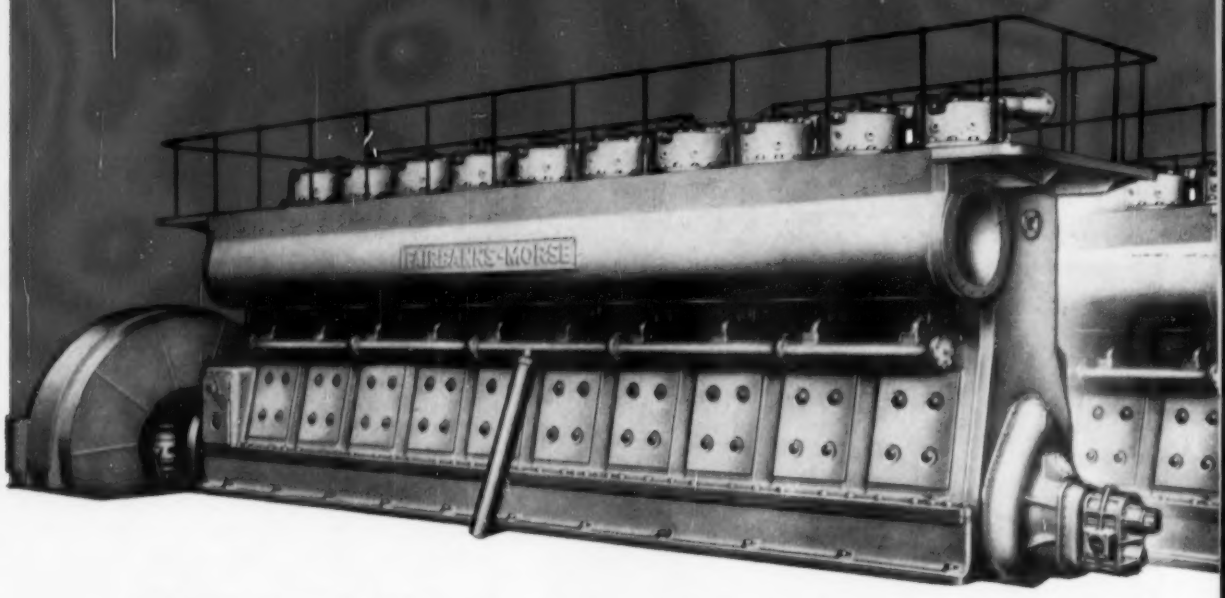
DETROIT DIESEL

Engine Division of General Motors • Detroit 28, Michigan

Single Engines . . . 30 to 300 H.P. Multiple Units . . . Up to 893 H.P.

AMERICA'S LARGEST BUILDER OF DIESEL ENGINES

Fairbanks-Morse tops REA



Record 43,300 Hp. Performance

In the top four plants of the national REA competition, there is more than two and a half times as much Fairbanks-Morse horsepower as in all other engines combined—a total of 43,300 horsepower.

Never before has there been such a clear-cut record of efficiency, on such a broad base, in favor of any engine in this competition.

Look at some of the figures:

- First, F-M horsepower produced more than 2/3 of the total power generated by the top four winning plants.
- Three 3500 horsepower Model 31A's generated 82% of the power in the top award-winning Johnson plant.
- Two exclusive F-M powered plants placed second and fourth with only a spread of .1 mill between them.
- One Model 31 in the Top Plant carried the highest penalty of longest operation on straight oil—yet efficiency was higher than plant average.

Here, in engine after engine, is a record of operating standards of efficiency unequaled by any other engine in such numbers.

You Can't Make a Better Power Buy Than a Fairbanks-Morse Diesel or Dual Fuel Engine

FAIRBANKS-MORSE

a name worth remembering when you want the best

DIESEL AND DUAL FUEL ENGINES • DIESEL LOCOMOTIVES • RAIL CARS • ELECTRICAL MACHINERY • PUMPS • SCALES
HOME WATER SERVICE EQUIPMENT • MOWERS • MAGNETOS

mass efficiency competition

Outstanding Single Engine Performance

Engine No. 6 is one of three Fairbanks-Morse Model 31A 3500 horsepower engines that have helped keep the Johnson plant tops in efficiency for four years*. In winning previously, this engine set a record of 9213 BTU per kw-h—still unsurpassed by any engine today.

That winning record automatically selected the big No. 6 for the heaviest assignment to straight oil operation this year when gas supplies became short. *Yet*, the engine achieved an average of 9642 BTU per kw-h (Better than plant average) and during one period of operation maintained, an average of 8652.

That's approximately 40% thermal efficiency!

Under all conditions of load . . . penalties of straight oil operation . . . two high-altitude plant locations—close scrutiny of performance records of this year's winning plants clearly establishes the fact—you can't make a better buy than a Fairbanks-Morse Diesel or Dual Fuel Engine. Fairbanks, Morse & Co., Chicago 5, Ill.

*The Johnson plant also delivered top kw-h per BTU last year, but was eliminated from competition due to winning in two previous years

AUTHORIZED FUEL INJECTION SERVICE

prompt • efficient • reliable

For "original maker" quality service on your diesel fuel injection equipment—just get in touch with your nearest official American Bosch service station (see list at right). Here factory-trained experts will give you prompt, efficient service, using specially designed tools and test equipment plus genuine American Bosch replacement parts. It all adds up to fast, accurate repair work that will save you time and money and keep your diesels on the go.

AMERICAN BOSCH

Springfield 7, Massachusetts

A Division of American Bosch Arma Corporation

AMERICAN BOSCH FUEL INJECTION SERVICE STATIONS

ALABAMA
Birmingham, 3	Birmingham Electric Battery Co.

ARIZONA
Casa Grande	Diesel-Electric Service Co.
Mesa	Perkins Diesel Service
Phoenix	Charlie C. Jones Battery & Electric Co.
Tucson	Auto Plane Electrical Service
Yuma	Yuma Automotive Electric

ARKANSAS
N. Little Rock	Womack Bros. & Taylor

CALIFORNIA
Bakersfield	Automotive Diesel & Electric Co., Inc.
El Centro	Valley Automotive & Diesel Serv. Co.
Eureka	Gustafson Diesel & Electric
Fresno	Winther Bros.
Los Angeles	Diesel Precision Company, Inc.
Los Angeles, 21	Magneto Sales & Service Co., Inc.
Oakland	Diesel Injection & Governor Serv., Inc.
Oakland	Pimental & Son
Sacramento	Diesel Pump & Injector Service
Sacramento, 6	Langner & Rifkin
Salinas	Haag Diesel & Electric
San Bernardino	Diesel Injection Service
San Diego	Electric Diesel & Equipment Co.
San Francisco, 24	McKinley Corporation of California
South Gate	Diesel Fuel Injection Lab.
Wilmington	Diesel Control Corp.

COLORADO
Denver, 3	Central Auto Electric Company

CONNECTICUT
Hartford	W. J. Connell Co. of Hartford

DISTRICT OF COLUMBIA
Washington	Diesel & Ignition Service Inc.

FLORIDA
Jacksonville	Diesel Electric Service, Inc.
Jacksonville	Patten Sales Co., Inc.
Miami	Dade Diesel Company
Miami, 36	Florida Diesel Service Co.
Orlando	Interstate Diesel Service
Tampa	Stuart Diesel Service

GEORGIA
Atlanta, 3	Auto Electric & Magneto Co.
Cairo	Grady Motors

IDAHO
Blackfoot	Auto Parts Service Co.
Boise	Magneto & Diesel Supply Co.
Lewiston	Osterman Diesel & Electric Co.
Twin Falls	Diesel Pump & Injector Service

ILLINOIS
Chicago, 16	Illinois Auto Electric Co.
Mendata	Walzer's Diesel Service
Peoria	Automotive Ignition Co.
Rock Island	Lohse Automotive Service

INDIANA
Indianapolis, 4	Gulling Auto Electric Inc.
Montone	Smith Brothers Garage
Valparaiso	Diesel Service Company

IOWA
Des Moines	Electrical Service & Sales Co.
Marshalltown	Heuer Equipment

KANSAS
Garden City	Bell Diesel Injection Service
Great Bend	Bell Engine Service
Grinnell	Grinnell Electric & Diesel Service Co.
Salina	The Motor Service Company
Wichita, 2	E. S. Cowie Electric Co.

KENTUCKY
Louisville	Diesel Injection Service
Louisville	Schaaf Auto Electric Co.
Paducah	Story Electric & Battery Co.

LOUISIANA
Baton Rouge	Womack Bros. Diesel Service
Bossier City	Vaughan Tractor & Auto Parts Co.
Morgan City	Landry's Diesel Injector Service
New Orleans	Gerhardt's Inc.
New Orleans, 13	John M. Walton, Inc.

MAINE
Portland	Eastern Diesel Service Co.
Portland, 5	Portland Tractor Co., Inc.

MARYLAND
Baltimore, 1	Parks and Hull Automotive Corp.
Baltimore	Stephen Seth & Co.

MASSACHUSETTS
Boston	Boston Fuel Injection & Engine Service
Boston, 64	W. J. Connell Company
Boston, 10	Wharf Machine & Electric Co., Inc.
Fairhaven	Hathaway Machinery Co., Inc.
Springfield	C. A. Krohne & Sons

MICHIGAN
Detroit	Knorr-Maynard, Inc.
Lansing	Diesel Equipment Sales & Service

MINNESOTA
Hibbing	Diesel Service Company
Minneapolis	Diesel Service Company
Minneapolis, 2	Reinhard Bros. Co., Inc.

MISSISSIPPI
Jackson	Womack Brothers

MISSOURI
Kansas City, 8	Electrical & Magneto Service Co.
St. Louis, 23	Diesel Fuel Injection Service Co.
St. Louis, 3	Electric Parts and Service Co.

MONTANA
Billings	Original Equipment, Inc.
Havre	Midwest Diesel Injection Sales & Service

NEBRASKA
McCook	Automotive Sales & Service
Omaha, 2	Carl A. Anderson, Inc.

NEW JERSEY
Newark, 2	Tire Trading Company, Inc.
Somerville	Battery & Electric Service Co.
Trenton, 9	Steinert Diesel Injection Service

NEW MEXICO
Albuquerque	Central Auto Electric Company

NEW YORK
Brooklyn	A & D Diesel Service, Inc.
Buffalo, 8	Hettrich Electric Service
Hempstead, L. I.	A & D Diesel Service, Inc.
Pelham Manor	Coretti-Gross, Inc.
Rochester	Union Carburetor & Ignition Service
Troy	Ehrlich Electric Service, Inc.
Utica	Stiefvater Electric Co., Inc.
Woodside, 77	American Bosch Div. American Bosch Arma Corp.

NORTH CAROLINA
Charlotte	Carolina Rim & Wheel Co.
Raleigh	Diesel Injection Sales & Service

NORTH DAKOTA
Fargo	Northwestern Diesel Service Co.
Minot	Diesel Service Company
Williston	Crighton Motor Co.

OHIO
Akron	Standard Motor Parts
Cincinnati	Tri-State Distributing Corp.
Cleveland, 14	The Cleveland Ignition Co.
Columbus, 15	Columbus Ignition Co.
Lisbon	Lisbon Diesel & Supply Co., Inc.
Sidney	Hoover Body & Diesel Service Co.

OKLAHOMA
Oklahoma City, 2	American Electric-Ignition Co.
Tulsa	Magneto Ignition Company

OREGON
Klamath Falls	Specialized Service Co.
Pendleton	Eds Magneto & Diesel Co.
Portland, 14	Automotive Products, Inc.
Roseburg	Diesel Injection Service

PENNSYLVANIA
Harrisburg	Penn Diesel Service Co.
Hazleton	Penn Diesel Service Co.
Mt. Carmel	Gengler's Diesel Service & Sales
Philadelphia	North American Diesel Injection Co.
Philadelphia	Sullivan Brothers
Phillipsburg	Keystone Diesel Inj. Service
Pittsburgh, 6	Automotive Ignition Co., Inc.

SOUTH CAROLINA
Charleston	Diesel Fuel Injection Service
Columbia	Boney Diesel Works Co., Inc.

SOUTH DAKOTA
Lemmon	Josund Auto Electric
Rapid City	Hoseth Auto Electric
Sioux Falls	Reinhard Brothers Company

TENNESSEE
Knoxville, 15	Diesel-Magneto Service Co.
Memphis, 4	Automotive Elec. Service Co.
Nashville	Precision Parts Corp.

TEXAS
Beaumont	Diesel Engine & Pump Co.
Dallas, 1	Beard & Stone Electric Co., Inc.
El Paso	Reynolds Batt. & Mag. Co.
Houston, 1	Beard & Stone Electric Co., Inc.
Houston	Diesel Pump & Injector Service
Houston	Magneto & Diesel Injector Service
Odessa	Electric Service & Supply
Pampa	Radcliff Bros. Elec. Co.
San Antonio	S. X. Callahan
San Antonio	Womack Bros.

UTAH
Salt Lake City	Diesel Electric Service & Supply Co.
Salt Lake City	Midwest Service & Supply Co.

VIRGINIA
Norfolk	Diesel Injection Sales and Service
Richmond	C. H. Woodward Electric Co., Inc.
Salem	Diesel Injection Sales & Service

WASHINGTON
Seattle	Seattle Injector & Electric Co.
Spokane	Spokane Diesel & Electric Co.
Spokane	Sunset Electric Co.
Walla Walla	Walla Walla Motor Supply, Inc.
Yakima	Diesel & Electric Service Co.

WEST VIRGINIA
Charleston	Mountain Service

WISCONSIN
Milwaukee, 2	Wisconsin Magneto Company

WYOMING
Casper	Cotter Battery & Electric Company
Mills	Diesel Service Company

ALASKA
Anchorage	Automotive Diesel Electric Supply & Overhaul
Juneau	Van's Diesel Service

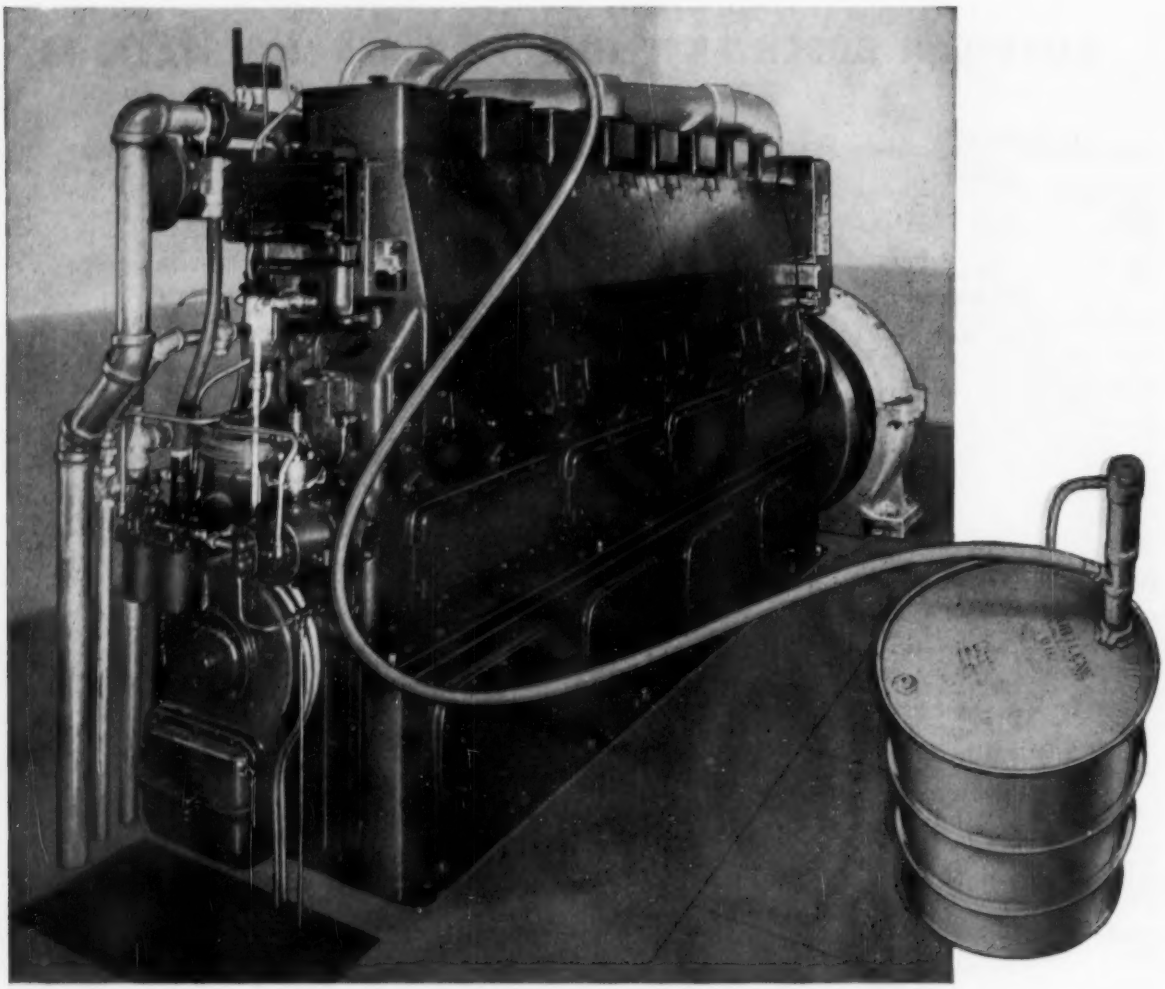
CANADA
Calgary, Alta	Hutton's, Ltd.
Edmonton, Alta.	Smith Battery & Auto Electric
Fredericton, N.B.	Stairs Bros. Fuel Injection Service Station
London, Ont.	Universal Ignition & Battery Ltd.
Montreal, Que.	International Electric Co., Ltd.
Montreal, Que.	Northam Equipment, Ltd.
Ottawa, Ont.	Welch & Johnston, Ltd.
Peterborough, Ont.	A. C. Curtis, Ltd.
Quebec, Que.	Quebec Gas & Diesel Engines, Ltd.
Regina, Sask.	Electric Motor Service
St. John's (Newfoundland)	A. H. Murray & Co., Ltd.
Saskatoon, Sask.	Lambert Electric, Ltd.
Toronto, Ont.	A. Cross & Co., Ltd.
Toronto, Ont.	Auto Electric Service Co., Ltd.
Toronto, Ont.	Westway Auto Electric Ltd.
Vancouver, B. C.	Fred Holmes Fuel Inj. Sales & Service Ltd.
Vancouver, B. C.	Jeffree & Jeffree, Ltd.
Vancouver, B. C.	Vivian Diesels & Munitions, Ltd.
Winnipeg, Man.	Brown & Murray, Ltd.

HAWAII
Honolulu	Honolulu Iron Works Company
Honolulu	Kawaiahao Ltd.
Honolulu	Todoki Machine & Marine Works

PUERTO RICO
San Juan	General Farm Equipment Co.

(List of foreign service stations available on request)

4095



Stops Thin-Out!

You can protect your Diesel against wear due to excessive thin-out of the lubricating oil at higher operating temperatures. Switch to Sinclair RUBILENE®, *the high viscosity index oil* proved by over 35 years in a wide variety of Diesel applications. You'll find RUBILENE holds its high film strength and reduces oil consumption . . . gives you better protection of cylinders, pistons, rings and other vital moving parts operating continuously for long periods. Your Diesel logs more full-power hours!

Switch now to RUBILENE. Regardless of the make of your Diesel, there's a member of Sinclair's famous RUBILENE or RUBILENE HD family that meets your needs exactly! Call your local Sinclair Representative or write for free literature to Sinclair Refining Company, Technical Service Division, 600 Fifth Avenue, New York 20, N. Y. *There's no obligation!*

SINCLAIR

RUBILENE OILS

Superior DUAL-FUEL ENGINES

CUT OPERATING COSTS

in New York sewage treatment plant

Six Model 80 Superior Dual-Fuel Engines, operating 92% of the time on sewage gas, run six 1125 KVA generators to provide the sole power source for all plant equipment at The Department of Public Works, Owl's Head Sewage Treatment Plant, New York City, having a capacity of 160 million gallons per day.

After a total of 78,000 hours running time, the New York maintenance crew completed the first overhaul of the six Superior engines. Practically no major part replacements were necessary! There was no noticeable wear on the cylinder liners, bearings or other vital parts! Since the engines were torn down, piston rings were replaced; but the old rings were still good enough to save for spares! Records show very low lube oil consumption and pilot fuel costs figure out to only 9 tenths of a mill per KWH. This Superior performance is cutting operating costs to a bare minimum at New York's Owl's Head Plant!

Similarly outstanding performance records are being established throughout the U.S.A., and most other parts of the world where Superior and Atlas Diesels are used for all kinds of power needs. For complete details on how Superior and Atlas power can cut operating costs for you, contact the nearest sales and service office listed below.

Superior ENGINES ATLAS Imperial DIESEL ENGINES White DIESEL

WHITE DIESEL ENGINE DIVISION

THE WHITE MOTOR COMPANY • *Plant and General Offices: Springfield, Ohio*

SALES AND SERVICE POINTS: Gloucester, Mass. • Houston, Ft. Worth, Texas • San Diego, Oakland, Terminal Island, California • Ketchikan, Alaska • Washington, D.C. • Portland, Astoria, Oregon • Casper, Wyoming • Halifax, Nova Scotia • Vancouver, B.C. • Park Rapids, Minnesota • New York • Chicago • Seattle • New Orleans • St. Louis • Wichita, Kansas

ADD PUSH... SUBTRACT FUEL!

AiResearch Turbochargers give your diesel far greater power while actually decreasing fuel consumption, noise and smoke!

In mobile diesel engines, where size, weight and fuel capacity must be limited, AiResearch Turbochargers add more power per inch, pound or gallon of fuel than any comparable installation.

An example is the remarkable success achieved in the recent application of these power packages to Caterpillar diesel machinery.

Equally impressive power increases can be achieved in the application of AiResearch Turbochargers to stationary diesel equipment. Here, the outstanding benefits added to the output boost will be lower operating costs and abatement of noise and smoke problems.

AiResearch is the largest producer of small turbomachinery in the United States, with twenty-five *million* hours of experience. This unmatched experience explains why AiResearch Turbochargers lead in power, economy and dependability. Your inquiries are invited.

THE GARRETT CORPORATION

AiResearch Industrial Division

9225 Aviation Blvd., Los Angeles 45, California

DESIGNERS AND MANUFACTURERS OF TURBOCHARGERS AND RELATED MACHINERY

MaK

MAIN ENGINES

AUXILIARY ENGINES

DIESEL GENERATOR SETS

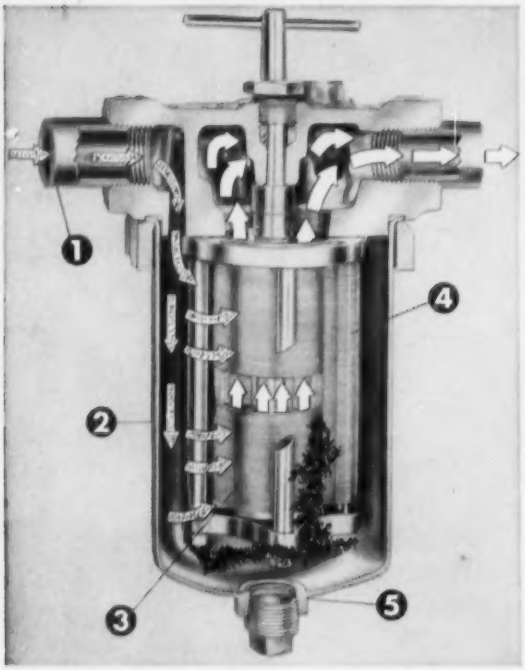
DIESEL PUMP EQUIPMENT

Supercharged or noncharged

MASCHINENBAU KIEL AKTIENGESELLSCHAFT

GERMANY

New CUNO SUPER Auto-Klean Filter can boost engine life up to 50%



HOW IT WORKS. Dirty oil enters inlet (1) at left, fills housing (2) and flows through metal edge-type filter. (3) Clean oil rises through center of filter, leaves at right. Dirt combed out by cleaner blades (4) is removed through drain (5).

Here's what the U.S. Army has done to test Cuno's new 40-micron SUPER Auto-Klean filter for their engines:

They ran destruction tests on several identical engines equipped with different brands of filters. As they ran, dust was introduced into the air intakes. When compression fell to half its initial value, the test was stopped. Best life for engines equipped with cartridge-type filters was 60 hours.

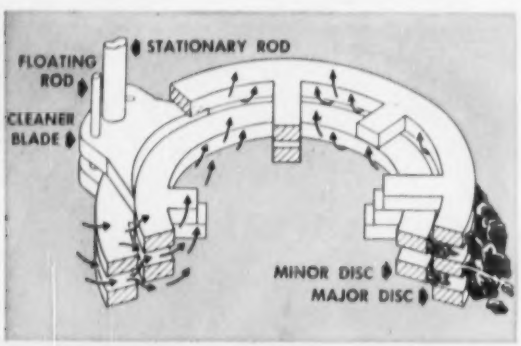
The engine with SUPER Auto-Klean ran 90 hours—50% longer—and *compression was still above half its initial value!*

You can get SUPER Auto-Klean now!

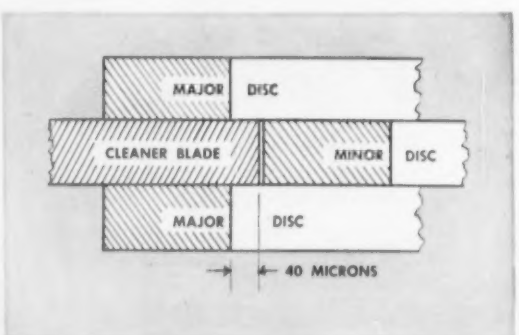
Just specify that the manufacturer equip your new diesel with this latest and best in filtration—both for fuel and full-flow lube. You'll get longer engine life and . . .

1. **Full-Flow** 40-micron filtration with a self-cleaning filter. No cartridge changes; filter can't rupture or channel.
2. **Low pressure drop.** An 8- by 2¾-inch filter element handles 30 gpm of 200 SSU lube oil with only 3 psi pressure drop. You get high capacity in a small package.
3. **All metal.** Can't absorb or adsorb additives from oil.
4. **No interruptions for cleaning.** Handles full flow all the time.
5. **Standard Auto-Klean housing.** On existing engines you can easily replace most 2¾ in. diameter cartridges with SUPER Auto-Klean or simply install SUPER Auto-Klean in the full-flow lube line following the discharge of the engine pump.

Write today for complete technical data on the new SUPER Auto-Klean for your new or existing diesel. Ask for Catalog No. SAK-057. Cuno Engineering Corporation, 9-5 South Vine Street, Meriden, Connecticut. 5.5



FILTER ELEMENT consists of stacked major and minor discs and cleaner blade bearing against precision ground minor disc. Oil flow is shown by arrows.



LARGE PARTICLES (over 0.012 in.) are stopped at space between major discs. Short 40-micron restriction stops 40-micron particles, but allows high flow rate.

CUNO

ENGINEERED FILTRATION

Removes More Sizes of Solids From More Kinds of Fluids

AUTO-KLEAN (edge-type) • MICRO-KLEAN (fibre cartridge) • FLO-KLEAN (wire-wound) • PORO-KLEAN (porous metal)

Rugged seal for a Rambler

LOCKS E. P. LUBE IN FOR A FAST PINION

In the dashing, new Rambler, the rear pinion may turn up to 3800 rpm—and, on a hot day, lube temperature may run 250° or more . . . and it is vital that the E.P. lubricant protecting this pinion be retained under all operating conditions. American Motors posed this key problem to Chicago Rawhide: provide a pinion seal that would more than withstand the temperature involved, and equally important, resist the deteriorating effects of a high sulphur content in E.P. lubricants. C/R engineers recommended the new C/R Type W Oil Seal. Result: this unique seal is delivering positive, dependable sealing performance under the most rugged road conditions.

Do you have a difficult sealing problem? C/R engineers will welcome the opportunity to work with you in the selection of the correct seal style and material for your application. Write for detailed information.

More automobiles, farm and industrial machines rely on C/R Oil Seals than on any similar sealing device.

CHICAGO RAWHIDE MANUFACTURING COMPANY
1213 Elston Avenue • Chicago 22, Illinois

Offices in 55 principal cities. See your telephone book.

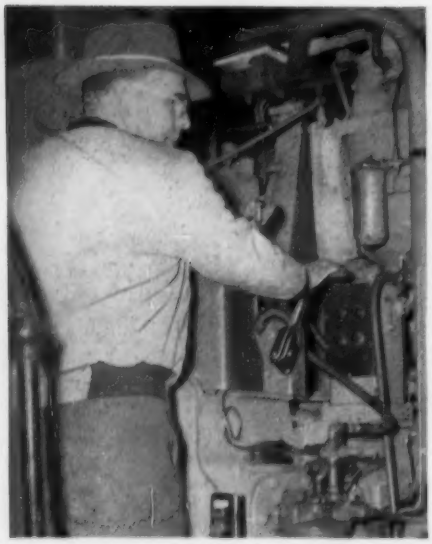
In Canada: Manufactured and Distributed by Super Oil Seal Mfg. Co., Ltd., Hamilton, Ontario

Export Sales: Geon International Corp., Great Neck, New York

OIL SEAL C/R DIVISION
CHICAGO RAWHIDE

Other C/R Products

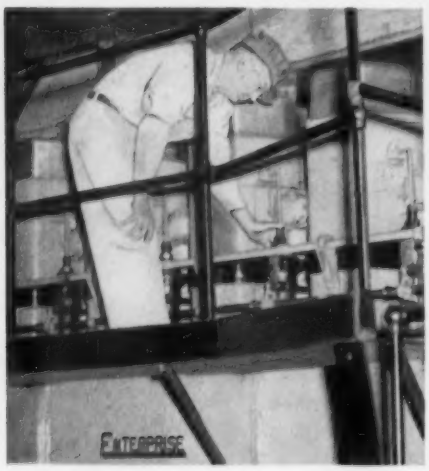
Sirvene (synthetic rubber) molded pliable parts • Sirvis-Conpor mechanical leather cups, packings, boots • C/R Non-metallic Gears

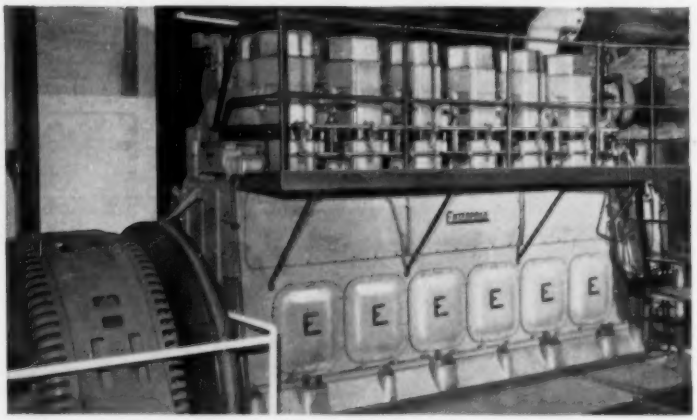


"We Added an Enterprise Dual Fuel Engine—Now Save $700 a Month on Fuel and Lube Oil Alone!"

Says JAMES J. LESLIE, Superintendent,
Paulding Light & Water Works, Ohio

At the Dual Fuel "Select-O-Matic"® control, "Pete" Leslie demonstrates ease of change-over from dual fuel to straight diesel operation of 1000 kw Enterprise. Engine never drops a cycle changing either way!





The 1400 HP Enterprise has logged over 21,000 hours without any major maintenance. Valves have not been ground, rings never replaced. No overhaul will be planned until there is some evidence of work required!

Chief Engineer Perry "Jack" Jackson on routine inspection of Enterprise Turbocharged Model DGSQ-316. After two and one half years on local natural gas and diesel fuel oil No. 2, firing pressures and exhaust temperatures have remained exceptionally even.

"Our Enterprise is one of four diesels in the plant, and it carries almost all of the load, 24 hours a day. That's because it's the most economical and dependable engine we've ever operated. Whether it's on dual fuel in normal periods, or on straight diesel during light loads of 300 kw or less, this engine performs very, very well. We like the safe margin of reserve it gives us, too—even during peaking periods."

Mr. "Pete" Leslie points out what a really profitable power plant means to the city of Paulding. Electric rates have been reduced substantially. Street lighting, power for the City Hall, and a beautiful municipal swimming pool have been provided at no cost to taxpayers.

This is another example of how cities and towns throughout America benefit from dependable Enterprise Engines. Write us today for full information, or call your nearest Enterprise office. Models from 73 to 7703 HP in diesel, dual fuel, tri-fuel and spark ignited gas engines.

Over a million horsepower at work the world over!

ENTERPRISE
dependable **ENGINES**

ENTERPRISE ENGINE & MACHINERY CO.
Subsidiary of General Metals Corporation
18th and Florida Streets, San Francisco 10, California
Export Department, New York

Boston • Chicago • Denver • Des Moines • Fort Worth • Huntington • Jacksonville • Kansas City • Los Angeles • Minneapolis
New Orleans • New York • Philadelphia • Pittsburgh • San Diego • Seattle • St. Louis • Tulsa • Washington, D.C.

DIESEL ENGINE TROUBLE CHART

POOR COMBUSTION:

Possible Cause

- Wrong fuel
- Wrong injection timing
- Sediment or slugs of water in fuel
- Leaky injection valve
- Carbon on injector
- Overheated injector
- Improper size orifice
- Subnormal compression temperature
- Injector valve sticking
- Weak injector valve spring
- Air in fuel lines
- Incorrect valve timing
- Leaky valve or valves
- Stuck piston rings
- Subnormal water jacket temperatures
- Worn cylinders
- Intake or exhaust ports clogged (2 cycle engines)
- Light loads
- Cold intake air
- Overlubricated cylinder walls

EXHAUST SMOKE:

Possible Cause

- Weak compression
- Sticking or worn nozzle
- Cetane fuel too low
- Excessive amount of oil reaching combustion chamber
- Unequal power output of cylinder
- Dirty air filter or silencer
- Misfiring
- Leaky inlet or exhaust
- Inadequate air supply
- Sticky or worn piston rings
- Inlet air or jacket water too cool
- Worn or scored cylinders

HIGH OIL TEMPERATURE:

Possible Cause

- Overheated bearing surfaces
- Not enough oil in circulation
- High water jacket temperatures
- Crankcase insufficiently cooled
- Plugged oil cooler
- Oil badly contaminated
- Late combustion
- Overloading

ENGINE OVERHEATS:

Possible Cause

- Lack of cooling water
- Incrustations in water jacket
- Obstruction to circulation of the water
- Damage to water pump
- Fuel injection too late
- Inadequate lubrication

CYLINDER WEAR:

Possible Cause

- Corrosion caused by water from products of combustion or by leaky head gasket
- Abrasive material from dust in air
- Sulphur loaded fuel
- Insufficient or incorrect oil
- Overheating
- Blow-by
- Frequent cold starts
- Piston ring pressure too high
- Misaligned connecting rod
- Cylinder distortion

HIGH OIL CONSUMPTION:

Possible Cause

- Loose bearing fits (in pressure system)
- Excess oil reaching cylinders
- Bearing end play excessive
- Plugged oil wiper rings
- Oil pressure too high
- Oil diluted with fuel
- Oil leaks
- Piston rings not fitting properly
- High oil temperature

CITIES SERVICE C-300 DIESEL OIL: ANSWER TO MANY PROBLEMS!

As is evident by the chart, many problems experienced with diesel engines can result from insufficient lubrication or the use of an unsuitable oil.

To avoid these problems before they begin, an increasing number of diesel operations have switched to Cities Service C-300 Diesel Oil. The reason: Cities Service C-300 is made from the finest base oils to conform to Military Specification MIL-0-2104A . . . is high detergent and high dispersant . . . strongly fortified against oxidation and corrosion.

But results are what count and here are the outstanding results reported by users of Cities Service Diesel Oil. Says a leading power plant: "We get 23,205 brake horsepower hours per gallon of lube oil." Says another: "Engine compressions are the same after four years as after three months; liners worn only .0015"." And still another reports over 30,000 hours of use on its Nordbergs—six years without any appreciable wear using Cities Service Diesel Oil!

In short, users are unanimous in praising Cities Service Diesel Oil as the finest they've ever used. Try it and you'll agree. Talk with your nearby Cities Service Lubrication Engineer. Or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

COMBUSTION CHAMBER DEPOSITS:

Possible Cause

- Dust from air
- Imperfect combustion
- Unsuitable oil

ENGINE ROUGHNESS:

Possible Cause

- Imperfect injection
- Cetane number of fuel too low
- Injection timed too early

SUDDEN STOPPAGE:

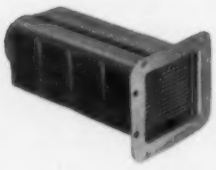
Possible Cause

- No fuel
- Water or air in fuel line
- Too heavy fuel
- Dirt or gum in fuel
- Plugged fuel line
- Lubrication failure
- Overheated engine
- Seized or tightened moving part of engine

COOL CROSSING

HARRISON KEEPS TEMPERATURES LEVEL ON POPULAR CIRCLE LINE FERRY BOAT

It's always smooth sailing . . . when Harrison drops anchor on the heat! Harrison heat exchangers keep operating temperatures at bay on today's high-powered marine diesels . . . assure cool performance with top efficiency and economy, even under heavy loads. You'll find Harrison specified in every line of industry—and national defense—from dump trucks to jet fighter planes . . . from hydraulic presses to submarines. That's because Harrison's 45 years' experience in design, research and manufacture pays off in top-quality heat control products. If you have a cooling problem, look to Harrison for the answer.

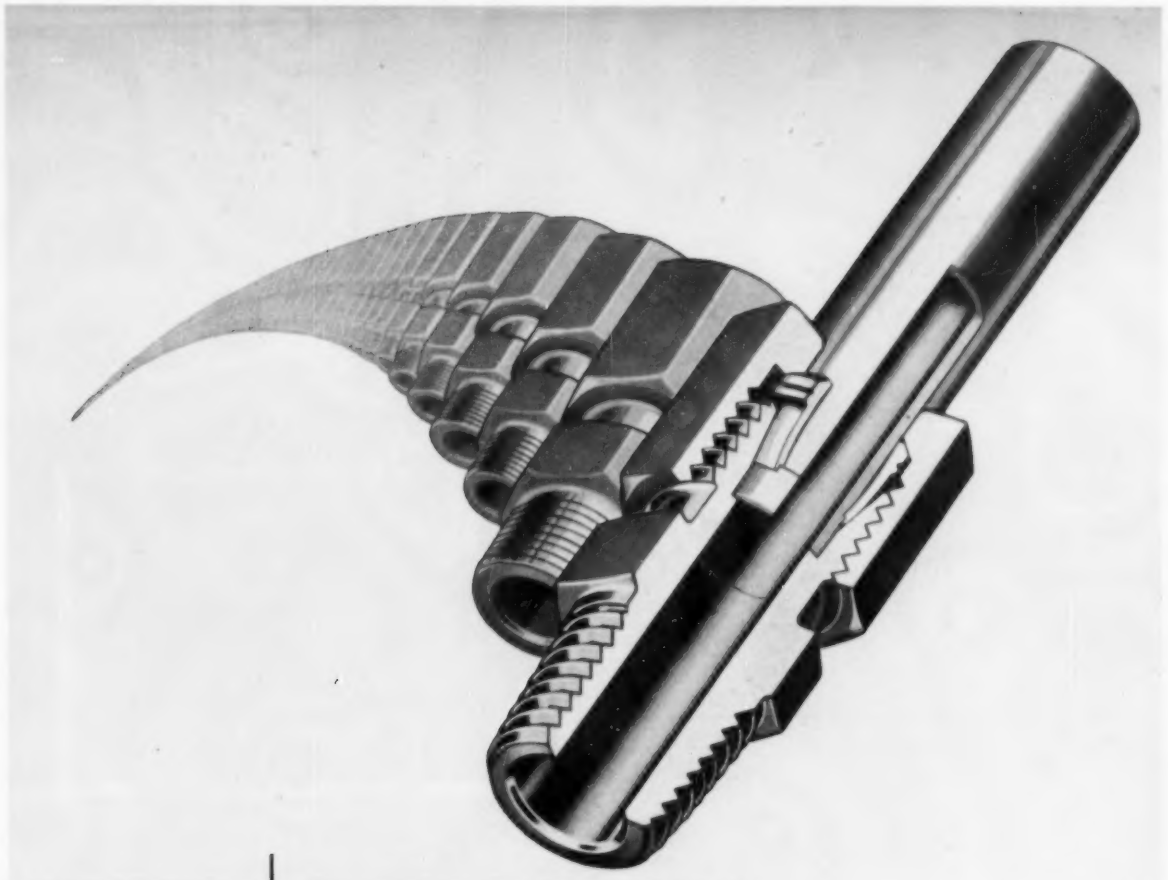


GM GENERAL MOTORS

HARRISON

RADIATOR DIVISION, GENERAL MOTORS CORP., LOCKPORT, N.Y.

TEMPERATURES MADE TO ORDER



When the pressure is on...

For leakproof connections...
that defy vibration and high pressure

specify **WEATHERHEAD ERMETO®**

When the pressure is on and positive vibration-resistant connections are a must . . . specify Weatherhead Ermeto® Connectors. Installation can be made in seconds with standard bench tools. There's no flaring . . . no threading . . . no welding . . . no soldering. The cutting and bowing action of the sleeve assures an unyielding leakproof seal . . . a joint that can be disassembled and reassembled time and time again. Write your nearby Weatherhead Distributor for detailed data.

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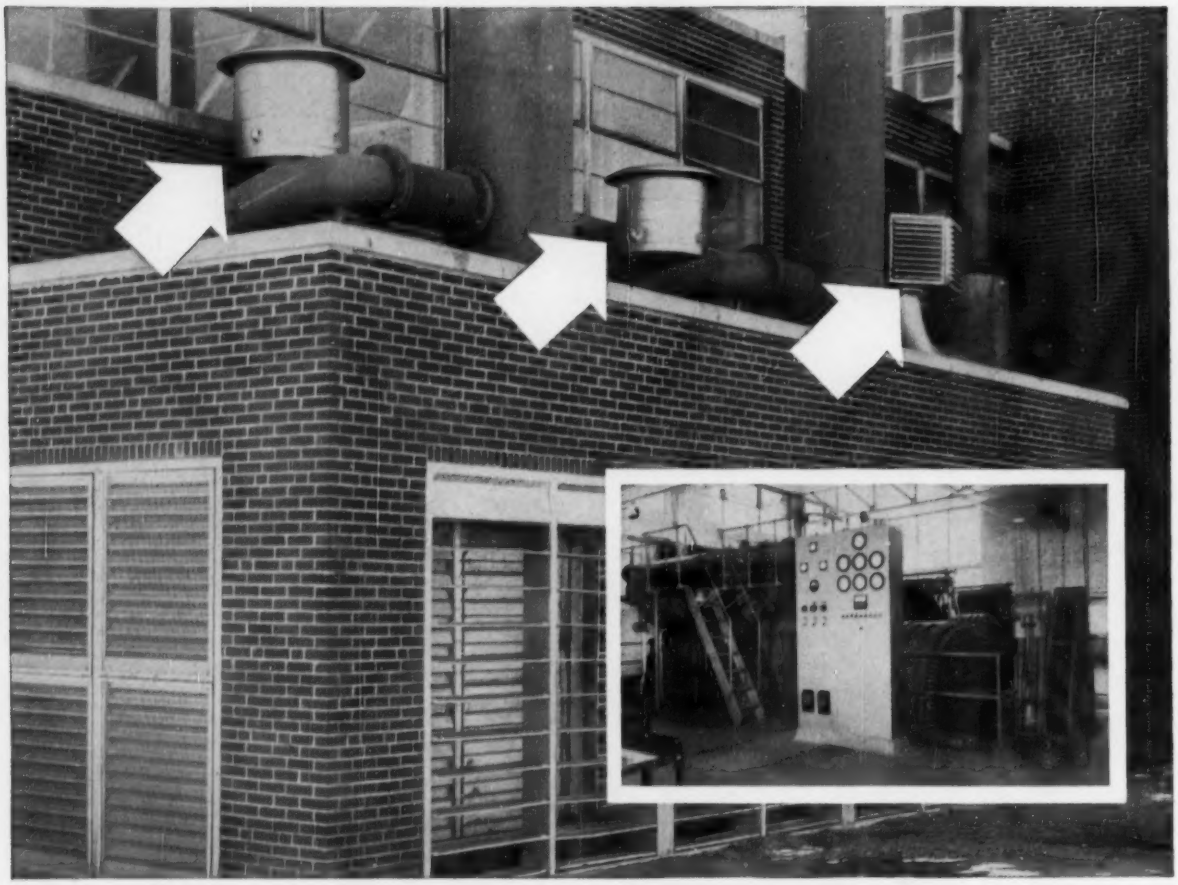
The Weatherhead Co., Fort Wayne Division
128 W. Washington Blvd., Fort Wayne, Ind.
In Canada: The Weatherhead Co., Ltd.
St. Thomas, Ontario

FIRST IN HYDRAULIC CONNECTIONS

DRAIN AND SHUTOFF COCKS | BULK HOSE AND REUSABLE HOSE ENDS | SAE 37° FLARE (JIC) FITTINGS | SELFALIGN® | ERMETO® | BRASS TUBE FITTINGS | HOSE ASSEMBLIES



Air-Maze filters on Cooper-Bessemer engines help Wolverine Cooperative win "most efficient" award

ENGINES, transformers, plant design—all contributed to the overall plant efficiency of Wolverine Electric Cooperative, this year's winner of "THE MOST EFFICIENT REA PLANT" award. Another big contribution was made by the two Air-Maze oil-bath filters and one DH panel assembly on the intakes of three Cooper-Bessemer dual fuel engines.

Air-Maze oil-bath filters scrub intake air in a pool of oil. An oil-washed screen filter traps any remaining dust, passing only clean, oil-free air. Air-Maze type DH ("dog house") panel assemblies clean intake air by trapping dirt in flat panel type filters. Abrasive dust and dirt can't get through to damage polished engine parts. Engines run smoother, wear is reduced, efficiency increased.

Thousands of America's diesels rely on Air-Maze filters for clean air, clean fuel oil, clean lube oil. They're specified by leading diesel engine manufacturers throughout the country. For full information on the hundreds of filter types and sizes engineered by Air-Maze, write the Air-Maze Corporation, Cleveland 28, Ohio.

AFI MEMBER AIR FILTER INSTITUTE

The biggest names in diesels are protected by Air-Maze filters

AIR FILTERS
SILENCERS
SPARK ARRESTERS

AIR-MAZE
The Filter Engineers

LIQUID FILTERS
OIL SEPARATORS
GREASE FILTERS

Governor theory, operation, and maintenance are covered in frequent classes conducted for visiting users of our products.

We're proud of our plant. Modern . . . immaculately clean . . . here highly skilled members of our industrial family produce precision Woodward Governors under the most favorable conditions. Stop in and visit us the next time you are in the vicinity of Rockford. We'll be glad to show you "The Woodward Way".

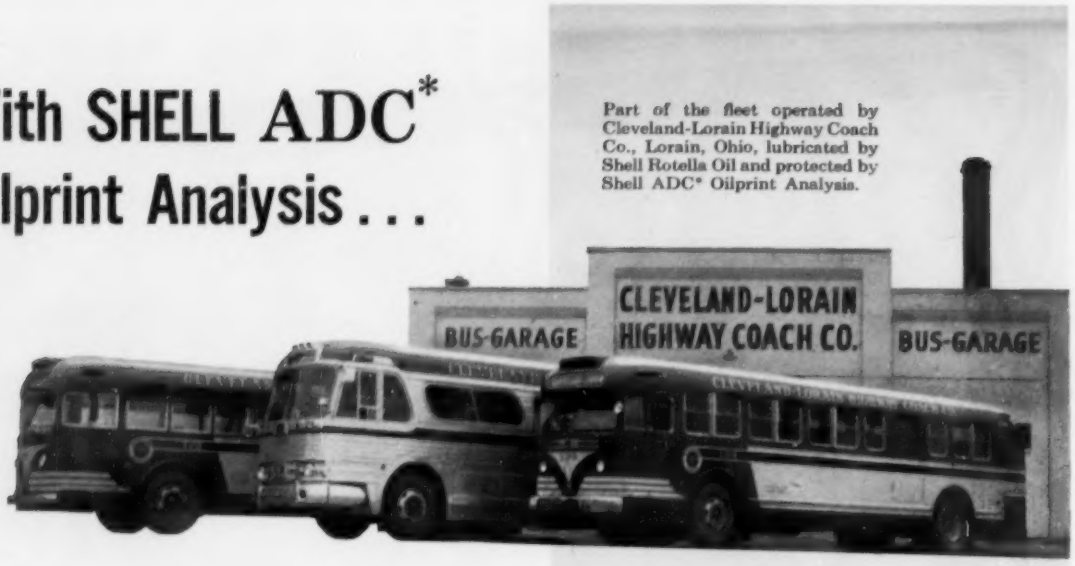
Visitors watch a machine operation in our shop. All work areas are well-lighted and air conditioned.

WOODWARD GOVERNOR COMPANY

Rockford, Illinois

WORLD'S OLDEST AND LARGEST MANUFACTURER OF HYDRAULIC GOVERNORS EXCLUSIVELY

With SHELL ADC* Oilprint Analysis . . .



Part of the fleet operated by Cleveland-Lorain Highway Coach Co., Lorain, Ohio, lubricated by Shell Rotella Oil and protected by Shell ADC* Oilprint Analysis.

"Extended oil drain intervals... lower repair costs"

HERE'S ANOTHER transportation company that has found the Shell ADC* Oilprint Analysis a cost-saving tool of preventive maintenance. By its use, oil drain intervals have been extended safely on some new diesel coaches.

Furthermore this fast, reliable oil check has revealed many potential troubles in advance, such as oil contamination due to block fracture . . . in time to save costly repair bills. The Cleveland-Lorain Highway Coach Co. is enthusiastic about it.

The Shell ADC Oilprint Analysis enables fleet operators to test crankcase oil in the short time allotted for re-fueling and crankcase oil checks . . . mere *minutes*. It eliminates draining still-good oil and the risk of using oils loaded with contaminants.

Let us demonstrate how we can put this new cost-saving PM tool to work for you.

*Trademark

One Drop tells the Story!

The operator places just one drop of oil on the card. Analysis gives conclusive check of oil's condition.

SHELL OIL COMPANY

50 WEST 50TH STREET, NEW YORK 20, NEW YORK
100 BUSH STREET, SAN FRANCISCO 6, CALIFORNIA

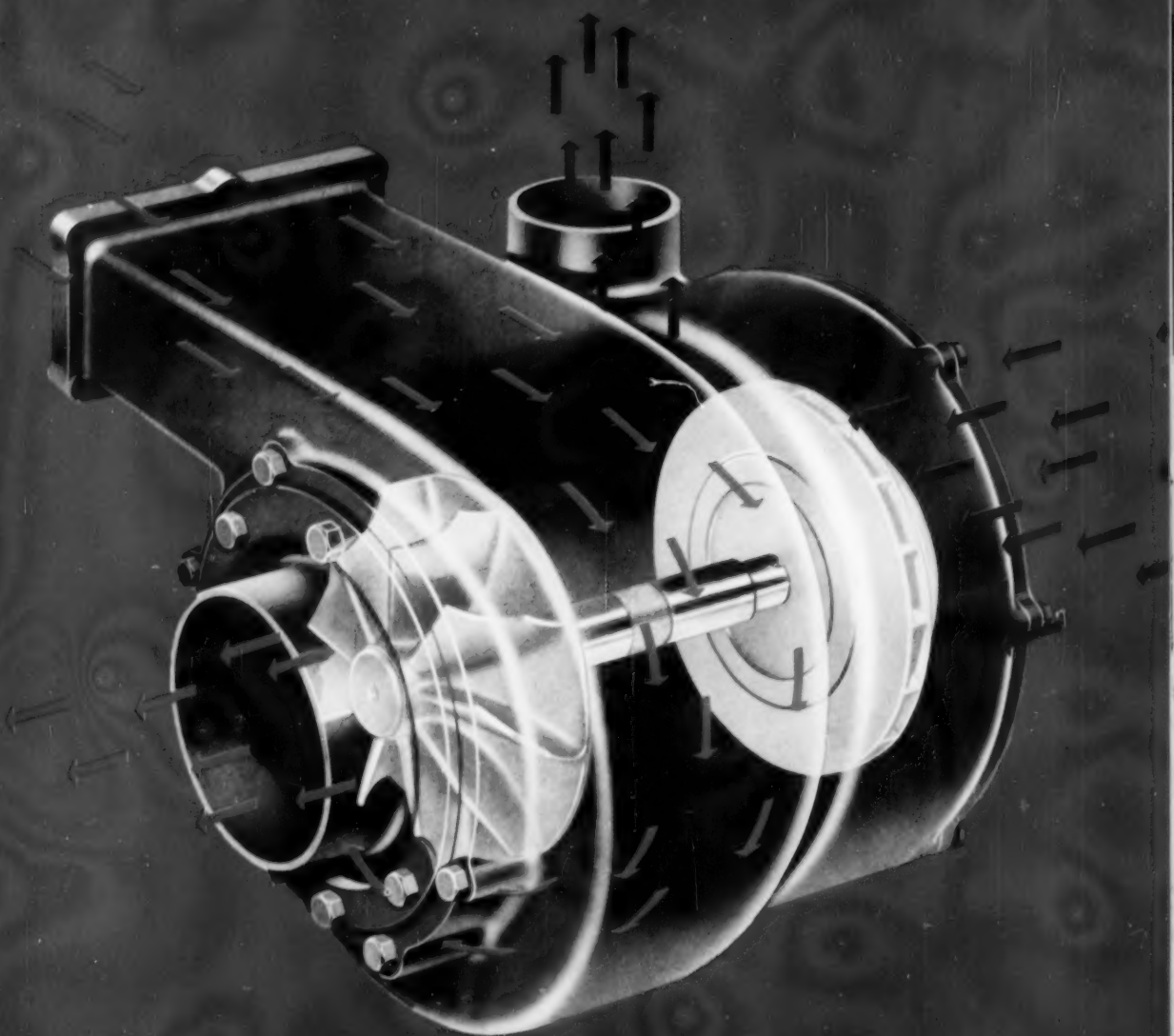
SHELL

NEW ADVANCE IN DIESEL POWER

CUMMINS **TURBODIESEL** ENGINE

(trademark)

ONLY CUMMINS OFFERS A COMPLETE LINE OF *TURBODIESELS*! . . . THE LATEST AND MOST ADVANCED IMPROVEMENT IN DIESEL POWER!



Cummins *TURBODIESELS* convert ordinarily wasted power into usable power! This means more work from the same amount of fuel.

A *TURBODIESEL* is a Cummins engine that utilizes the normally wasted energy of exhaust gases by means of a turbocharger to develop additional horsepower. More power is obtained from a *TURBODIESEL* than from a naturally aspirated engine or engine of equal displacement, reducing the weight per horsepower. By forcing more air into the cylinders, the turbocharger makes possible more efficient burning of a greater fuel charge, creating additional horsepower.

➡ The red arrows trace the flow of exhaust gases through a turbine chamber which turn a turbine wheel (left). The turbine wheel is mounted on the same shaft as the air impeller (right) in the air chamber.

➡ The blue arrows indicate how the rotation of this impeller draws air from the outside and blows it under pressure into the intake manifold and engine cylinders.

and what it offers to power users!

LOWER FUEL CONSUMPTION

Cummins *TURBODIESELS* deliver greater fuel economy than either non-supercharged or mechanically supercharged gasoline or diesel engines.

MORE HORSEPOWER, BETTER PERFORMANCE

Cummins *TURBODIESELS* deliver more horsepower than non-supercharged or mechanically supercharged diesel engines of equal displacement.

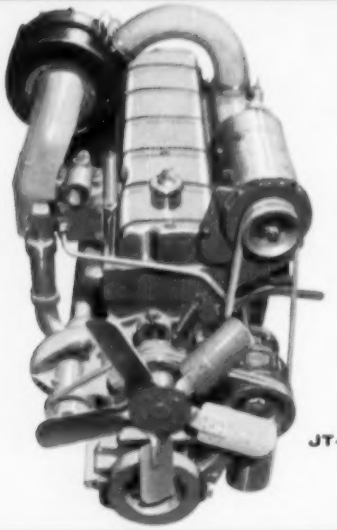
SMALLER SIZE, LOWER WEIGHT

Cummins *TURBODIESELS* are more compact, weigh less than non-supercharged or mechanically supercharged diesels of equivalent power.

How Cummins *TURBODIESELS* offer more profit to power users:

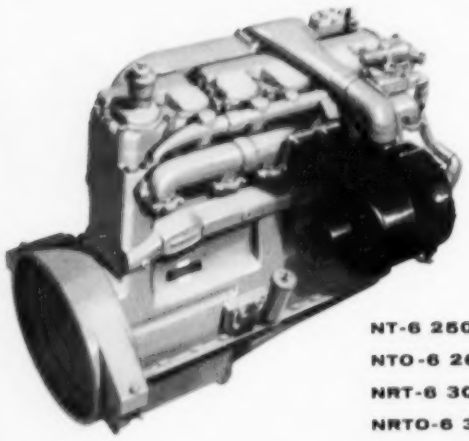
3 *big advantages!*	1 More work on the same amount of fuel!	2 More power for better performance!	3 More power per lb. of engine!
over non-supercharged diesels!	If a non-supercharged diesel does this much work per gallon of fuel:	If a non-supercharged diesel delivers this much horsepower per cubic inch of displacement:	If a non-supercharged diesel delivers this much horsepower per pound:
and over supercharged diesels!	a supercharged diesel will do this much work:	a supercharged diesel will deliver this much:	a supercharged diesel of equivalent weight will deliver this much power:
	but a Cummins *TURBODIESEL* will do more work per gallon of fuel than either!	but a Cummins *TURBODIESEL* will deliver more than either!	but a Cummins *TURBODIESEL* of equivalent weight will deliver more power than either!
If you run trucks or buses	"Work" is *mileage*. Cummins *TURBODIESELS* mean more ton-miles per gallon than gasoline or other diesel engines.	Cummins *TURBODIESELS* make possible faster schedules . . . better performance on hills . . . at altitudes . . . in traffic, than gasoline or other diesel engines.	Cummins *TURBODIESELS* make possible bigger pay loads . . . dependable diesel power and economy . . . more profit.
If you use construction, mining, logging, drilling or marine equipment	"Work" is production. Cummins *TURBODIESELS* work longer on the same amount of fuel than gasoline or other diesel engines.	Cummins *TURBODIESELS* make possible faster work cycles . . . greater work loads . . . better all-around performance.	Cummins *TURBODIESELS* increase payload capacities . . . simplify movement to location . . . allow greater cargoes.

Cummins offers a full range of power for all applications!



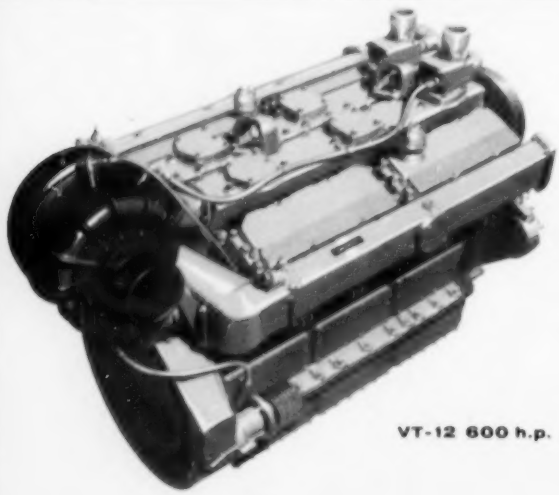
JT-6 175 h.p.

TRUCKS
BUSES
CONSTRUCTION
MARINE



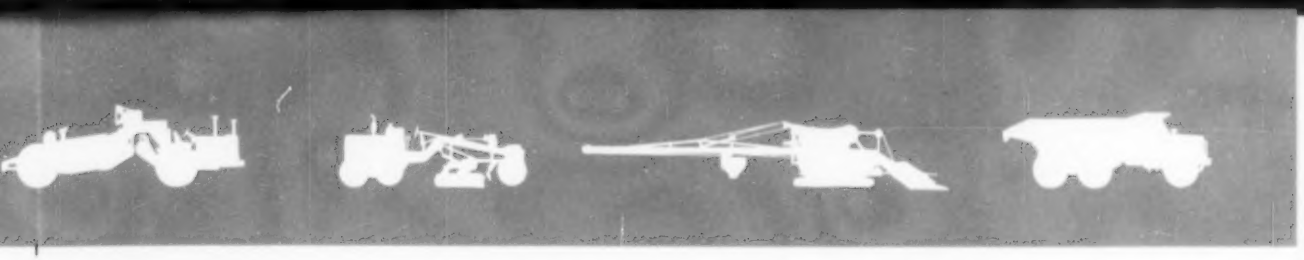
NT-6 250 h.p.
NTO-6 262 h.p.
NRT-6 300 h.p.
NRTO-6 335 h.p.

CONSTRUCTION
MINING
TRUCKS
LOGGING



VT-12 600 h.p.

MARINE
DRILLING RIGS
GENERATOR SETS
CONSTRUCTION



EFFICIENCY

Here is the engine that is revolutionizing the truck and bus industries. The JT weighs from 450 to 800 pounds less than other diesels of comparable power. This tremendous weight advantage means that diesel truck operators can earn from $1000 to $2000 in additional revenue every 100,000 miles. (Based on 300 trips of 300 miles each, and revenue of 80¢ per 100 lbs.)

More than 100 million miles of on-the-job performance have proved the JT's unmatched efficiency and economy as an automotive engine. The JT gives you maintenance costs lower than other diesels, *and as low as gasoline!* Compared to gasoline, the JT gives a 25% saving in maintenance hours!

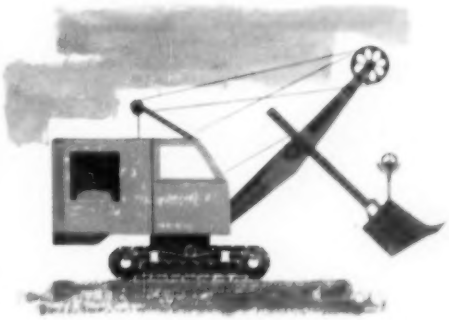
The JT also is ideal power for medium construction, mining or marine equipment. This engine delivers the rugged, dependable performance that cuts work cycles—lowers operating costs.

POWER

Any piece of equipment powered by an internal combustion engine in this horsepower range will operate more efficiently, and economically, powered by one of these four great Cummins *TURBODIESELS.*

Cummins gives you a choice of horsepower so that you can accurately tailor power to your job needs. This avoids the excessive initial costs inherent in overpowering . . . the excessive fuel and maintenance costs inherent in underpowering.

These four great *TURBODIESELS* are thoroughly job-proved. They are particularly popular in construction and mining equipment, where their big power makes possible faster work cycles and more payloads.



DEPENDABILITY

Here is big power in a compact package. No other commercially available engine of comparable horsepower approaches the VT-12 Cummins *TURBODIESEL* for light weight and small size. The VT is easily moved from one location to another. And it costs much less than heavier, slow-speed diesels which develop comparable horsepower.

The VT-12 *TURBODIESEL* can cut the cost in any installation which must be moved from location to location, such as an oil well drilling rig. It makes possible higher powered portable generator sets and pumping units. In marine applications, it frees valuable space for cargo carrying. The VT-12 can be compounded to provide up to 2,400 h.p.

Cummins *TURBODIESELS* give you these advantages, too!

RESEARCH AND PRODUCT DEVELOPMENT. Continuous pioneering, research, experimentation and quality building has helped make Cummins the world's leading independent manufacturer of diesel engines. Meeting the ever-changing needs of power users by being first with the latest advances in diesel design and engineering keep "Cummins" the finest name in diesels. For more information, write for the free booklet, "Answers to Questions about Diesels."

READILY AVAILABLE PARTS AND SERVICES. Cummins worldwide distributor organization . . . the largest devoted to the sale and service of diesel engines . . . offers expert service and genuine Cummins parts at nearly 200 points throughout the United States and Canada and in over 100 export locations. Special job-site service is also offered.

LOWER FUEL AND MAINTENANCE COSTS. Cummins simple 4-cycle, overhead valve design is easy to service—assures long engine life—requires little "between-overhaul" maintenance—is easily understood by mechanics. Cost of replacement parts is low, minimizing overhaul expense. Cummins exclusive PT fuel system contains fewer parts—is easier to understand and maintain than gasoline carburetion and ignition or other diesel fuel systems. Foolproof and troublefree, this revolutionary method of fuel injection drastically reduces downtime due to fuel system failures.

MINIMUM PARTS INVENTORIES. Bearings, pistons and many other parts are interchangeable on many Cummins models. This standardization reduces overhead in parts stock—assures time and space savings—lowers maintenance costs. All components are made to exacting engineering standards under strict quality control to assure uniformity . . . lower your overall maintenance costs.

SPECIFY CUMMINS WHEN YOU BUY. It's easy to standardize on Cummins Diesels. Over 80 manufacturers of heavy equipment offer Cummins Diesels as power in over 500 models. The names of these manufacturers can be yours for the asking. Get your free copy of "Cummins Who's Who" by writing to the Cummins address listed below.

CUMMINS *MORE PROFIT*

gives you the big plus

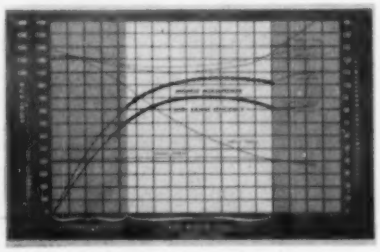
For further information consult the Cummins Distributor in your area or write direct to:

Cummins Engine Company, Inc.

Columbus, Indiana

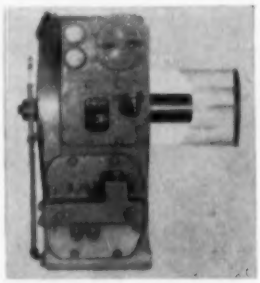
Bulletin 950135 LITHO U.S.A.

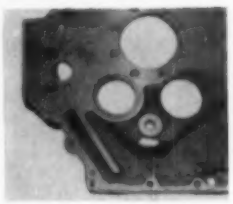
MORE WORK DONE, LESS MAINTENANCE
—these benefits are built in TORCON Torque Converters



* Engine efficiency and torque demand in constant balance...

Torcon design provides that the engine will operate at its most efficient speed, with torque multiplication to meet constantly changing demands. Torcon blade design eliminates cavitation, assures high efficiency throughout a wide working range.





* Integrated oil system...

Oil sump is an integral part of the housing casting—an important advantage. Internal oil passages are cast in the housing—reducing the number of parts, eliminating unnecessary hoses and fittings, preventing leakages that impair efficiency. Oil flows automatically to lubricate all working parts.

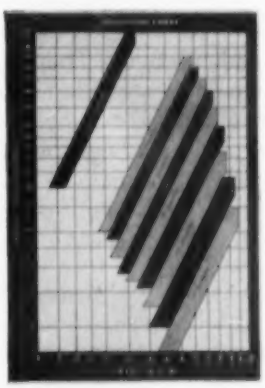
* Easy accessibility...

Ample sized cover plates are easily removable for quick inspection—no special tools required. Regulating valves are mounted on the outside of the housing, for immediate inspection.

* A complete line—15 to 600 HP

Torcon torque converters include mass-produced standard package units available to equipment manufacturers and to owners and operators for field installation.

A broad range of wheel diameters and options assures a unit that can be fitted readily into any power-transmission system.



THIS BULLETIN WILL BE HELPFUL

A brief, clear statement of Torcon features—well illustrated. Use the coupon.

CLARK EQUIPMENT COMPANY, Transmission Division
Foulahee Road, Jackson 11, Michigan
Please send me the Torcon Bulletin

NAME _____ POSITION _____

FIRM _____

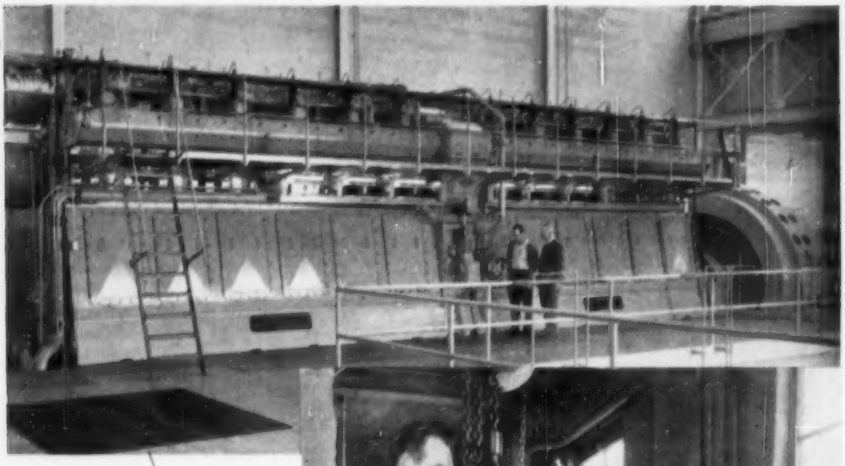
ADDRESS _____

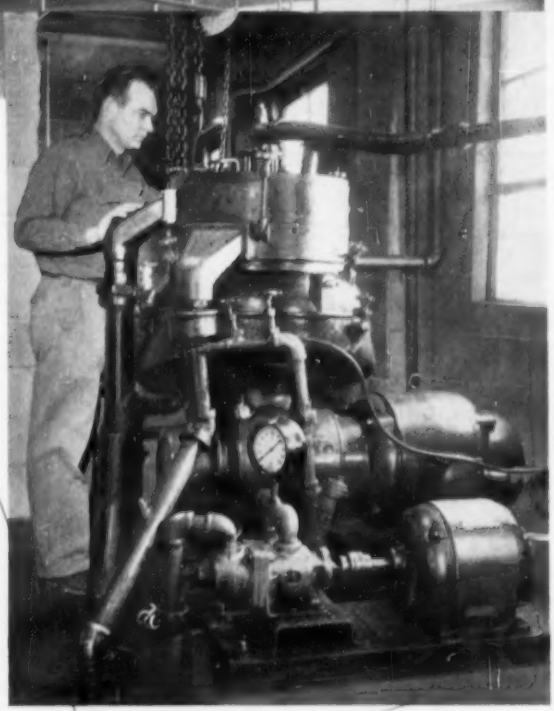
CITY _____ ZONE ____ STATE _____

CLARK® EQUIPMENT

CLARK EQUIPMENT COMPANY
Jackson, Michigan

DE LAVAL "NOZZLE-MATIC" SAVES $3,600 IN ONE MONTH!





When Decatur Public Utilities installed a De Laval AC-VO "Nozzle-Matic"* to purify heavy fuel for their 5380 HP Baldwin diesel, things really happened . . .

As Superintendent L. C. Pettibone reports it: The De Laval "Nozzle-Matic" not only completely purified poor grade No. 5 fuel, but made it possible to burn still cheaper No. 6! Savings over burning regular diesel fuel amounted to approximately $3,600.00 in one month of part-time operation. In over 3800 hours of operation no unusual ring or liner wear has been experienced.

Once again De Laval demonstrates that "If you can pump it, we can purify it." All the money-making facts are available to consulting engineers on request.

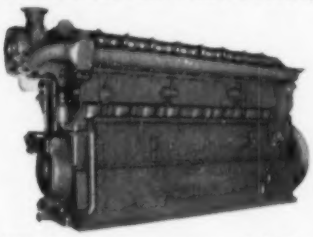
*Trademark

DE LAVAL
heavy oil purifiers

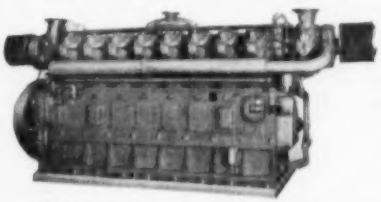
THE DE LAVAL SEPARATOR COMPANY Poughkeepsie, New York • 427 Randolph St., Chicago 6 • DE LAVAL PACIFIC CO. 201 E. Millbrae Ave., Millbrae, Calif.

TOP PERFORMING Cooper-Bessemers
for every heavy-duty power and compressor need

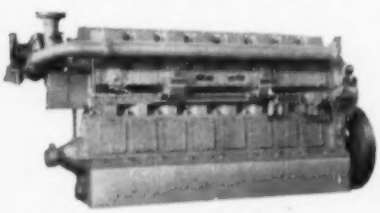
TYPE LSV . . . . . 12 or 16 cyl.
Atmospheric and Supercharged
Gas . . . . . 1440 to 5000 hp.
Diesel and Gas-Diesel . . 1650 to 5000 hp.



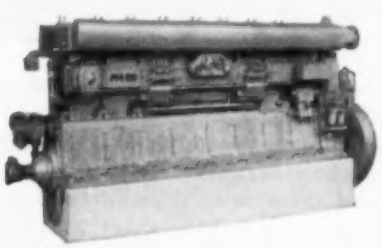
TYPE LS . . . . . 6, 7, 8 cyl.
Atmospheric and Supercharged
Gas . . . . . 660 to 2500 hp.
Diesel and Gas-Diesel . . 965 to 2500 hp.



TYPE FVA . . . . . 6, 8, 12 or 16 cyl.
Diesel — Atmospheric . . . . . 310 to 835 hp.
Diesel — Supercharged . . . 560 to 2200 hp.



TYPE JS . . . . . 5, 6, 7 or 8 cyl.
Atmospheric and Supercharged
Gas . . . . . 325 to 1815 hp.
Diesel and Gas-Diesel . . . . 430 to 1815 hp.



TYPE GS . . . . . 5, 6 or 8 cyl.
Atmospheric and Supercharged
Gas . . . . . 320 to 1460 hp.
Diesel and Gas Diesel . . . . 300 to 1460 hp.

• Available in a range of sizes from 100 to 5000 hp., Cooper-Bessemer engines and compressors are ready to meet *your exact requirements.*

The standard units shown here are typical of the many "top performers" now offered by Cooper-Bessemer. With "Tri Fuel" operation of most 4-cycle engines, and a new line of centrifugal compressors, Cooper-Bessemer continues to put into practice its policy of "Another Example of Efficient Power at Lower Cost".

Here, to list but a few, are plus values that make *every* Cooper-Bessemer a natural choice when it comes to purchasing new engines or compressors . . . low-cost operation, unmatched efficiency, extreme compactness, long-life dependability, easy accessibility, minimum maintenance and more than a century of engine building experience.

New bulletins offer the latest information. Get your copy by writing: The Cooper-Bessemer Corporation, Mt. Vernon, O.

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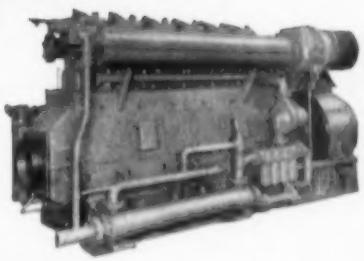
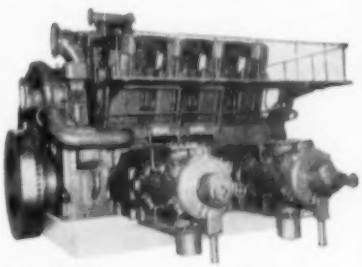
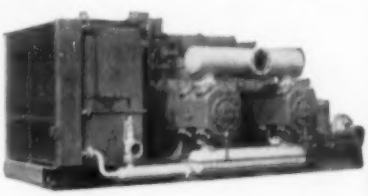


TYPE FWA . . . . . 6 cyl.
Diesel — Atmospheric . . . 245 to 500 hp.
Diesel — Supercharged . 420 to 835 hp.

TYPE GMWA . . . . . 6, 8 or 10 cyl.
Gas Engine Driven Compressors
. . . . . 1500 to 2500 hp.



TYPE GMVA . . . . . 4, 6, 8, 10 cyl.
Gas Engine Driven Compressors
. . . . . 540 to 1350 hp.



TYPE GMXD . . . . . 4, 6, 8 or 10 cyl.
Packaged Unit
Gas Engine Driven Compressor . 265 to 660 hp.

M-LINE RECIPROCATING COMPRESSORS
100 to 5000 hp. 9"-14" stroke
Speed to 514 RPM

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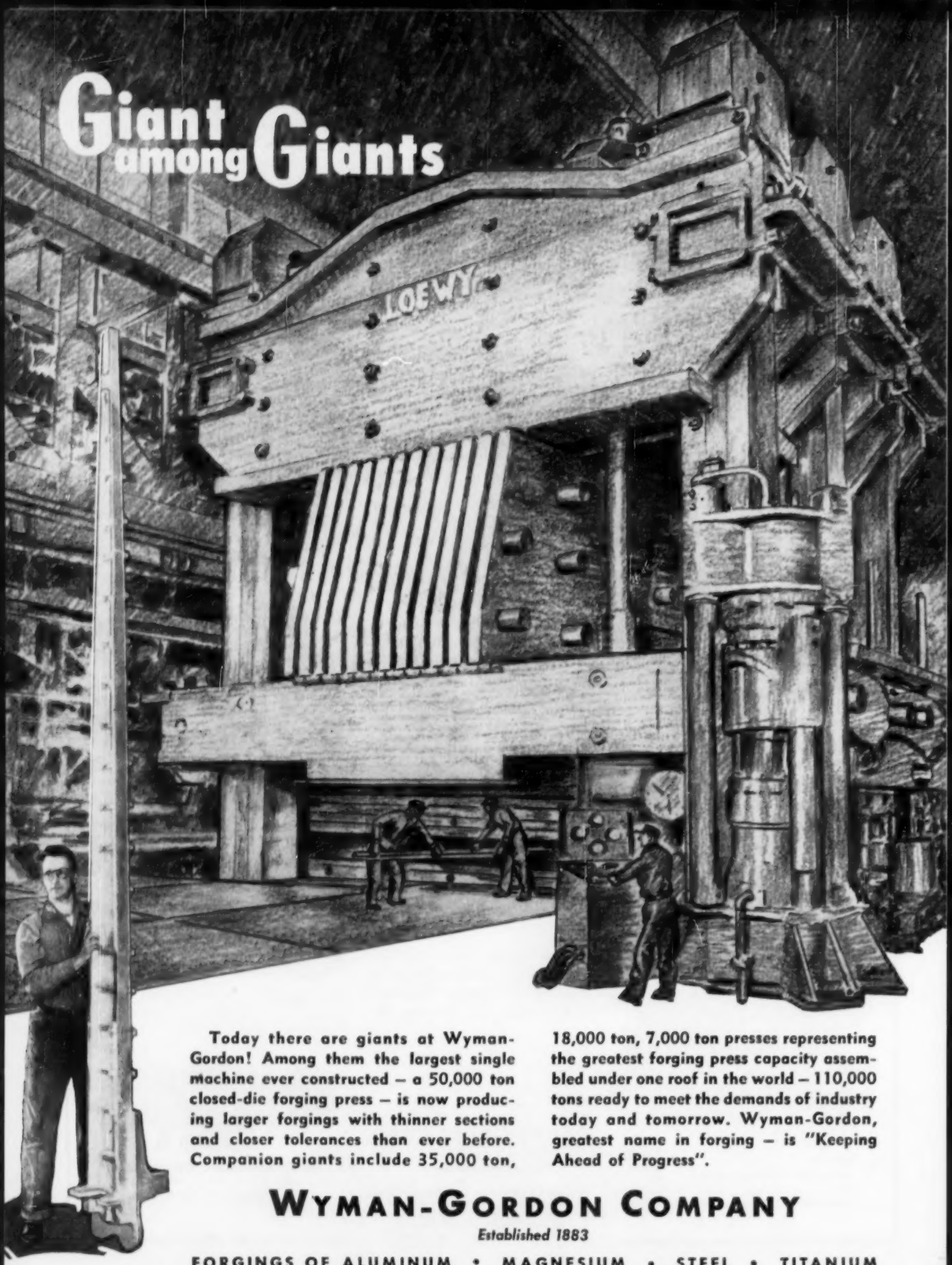

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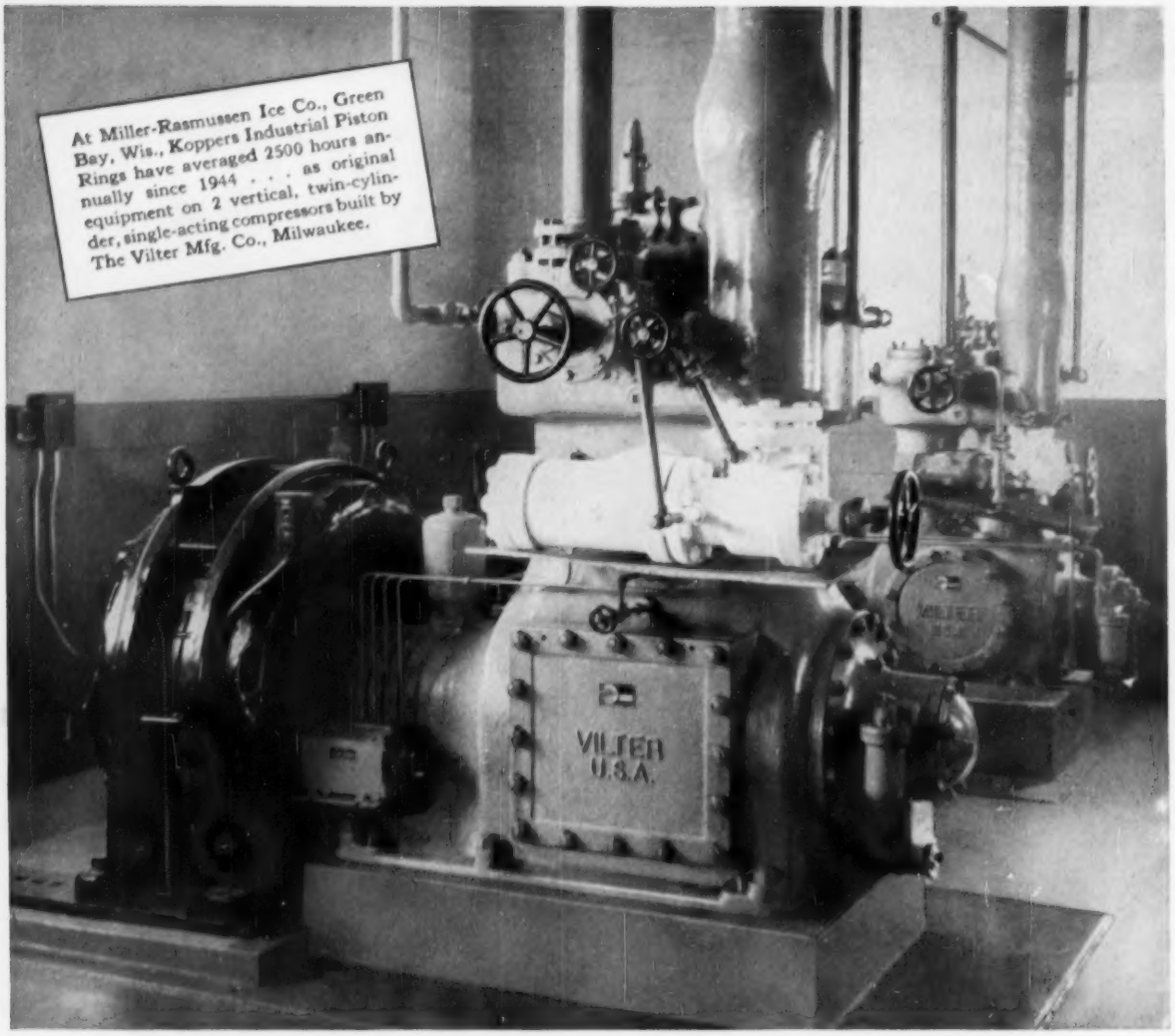
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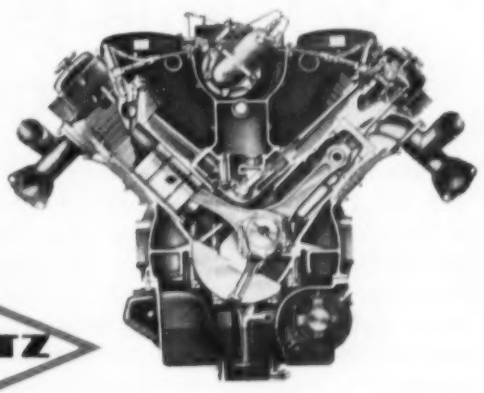
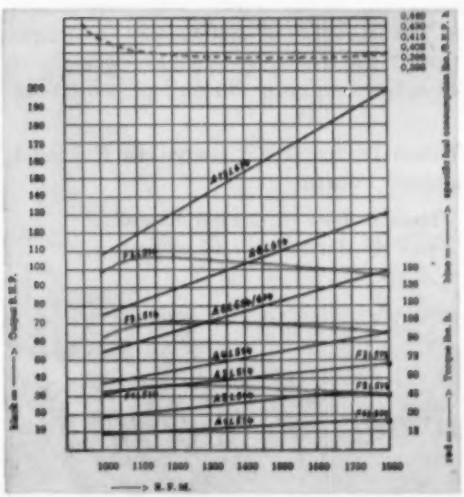
PERFORMANCE DATA

Type	A/F1L 514	A/F2L 514	A/F3L 514	A4L 514	A8L 514/614	A8L 614	A12L 614
Number of Cylinders	1	2	3	4	6/6 V	8 V	12 V
Rotation when facing Flywheel	left-hand						
Combustion Principle	Swirl-Chamber						
Speed R.P.M.	1000 1500 1800	1000 1500 1800	1000 1500 1800	1000 1500 1800	1000 1500 1800	1000 1500 1800	1000 1500 1800
Mean Piston Speed ft./min.	905,4 1378 1655	905,4 1378 1655	905,4 1378 1655	905,4 1378 1655	905,4 1378 1655	905,4 1378 1655	905,4 1378 1655
m./sec.	4,7 7,0 8,4	4,7 7,0 8,4	4,7 7,0 8,4	4,7 7,0 8,4	4,7 7,0 8,4	4,7 7,0 8,4	4,7 7,0 8,4
Continuous Rating A (10% Overload)							
(Heavy Duty) B.H.P.	8,3 12,5 —	16,5 25 —	25 37,5 —	33 50 —	50 75 —	65 100 —	100 150 —
Blocked Intermittent Rating B (Light Duty) B.H.P.	— 14 16	— 28 32	— 42 48	— 55 66	— 82 100	— 110 132	— 165 200
Mean Effective Pressure lb./sq. in.	— 89 85	— 89 85	— 89 85	— 87,8 87,8	— 87 86,6	— 87,8 87,8	— 87,8 86,6
kg./cm.²	— 6,3 6,0	— 6,3 6,0	— 6,3 6,0	— 6,2 6,2	— 6,16 6,28	— 6,2 6,2	— 6,2 6,28
for Tractors B.H.P./R.P.M.	15/1650	30/1600	45/1600	60/1650	90/1650	145/3000	220/2000
for Railcars B.H.P./R.P.M.				72/2000	110/2000		
Min. R.P.M. on Continuous Rating				900			
Min. Idling R.P.M.				500			
Max. Torque for AL Model ft. lbs. R.P.M.	44,8 1300	88,8 1300	129,8 1300	178,2 1300	271,6 1300	385 1400	842 1400
mkg	6,2	11,9	17,9	24,6	37,5	49	75
Max. Torque for FL Model ft. lbs R.P.M.	50,6 1200	104,6 1100	160,1 1200	—	—	—	—
mkg	7,0	14,5	22	—	—	—	—
Bore in.				4"/₀			
mm.				110			
Stroke in.				5"/₀			
mm.				140			
Swept Volume cu. in.	81,16	162,32	243,48	324,6	486,9	649,3	973,8

Thanks to its interchangeable units, the air-cooled Deutz diesel has been adapted to practically every application for which engines are used . . . from mobile equipment, such as tracked and wheeled tractors, excavators and locomotives, to such stationary equipment as generators, pumps and quarry power plants. Air-cooling gives the Deutz easy starting and fast warm-up, too. That's why more and more leading manufacturers are installing this engine in their products. The data recorded in the table above and on the chart below tell how the Deutz diesel can give your customers outstanding performances. And can give *you* outstanding sales! For further information, mail coupon below without delay. Dealer inquiries invited.





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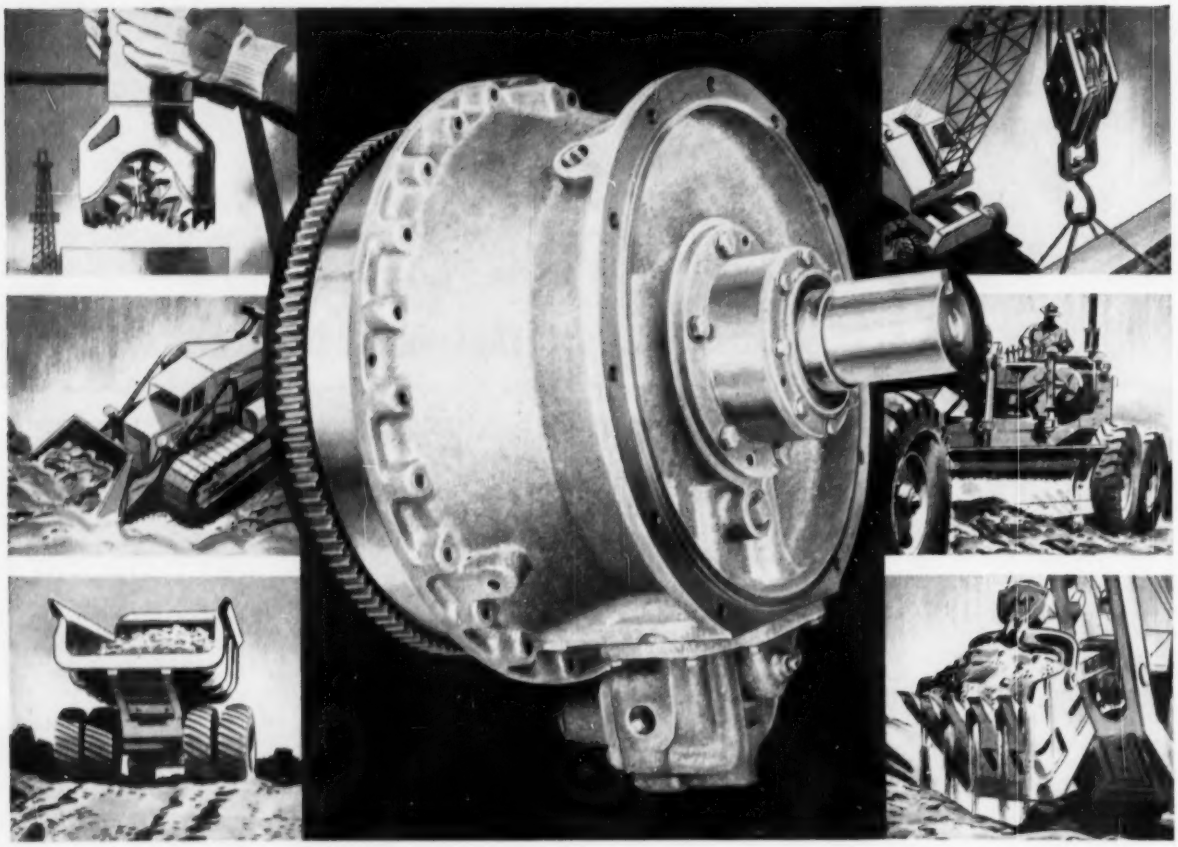

Versatile is the word for the Torqmatic 500

NAME the gasoline- or Diesel-powered equipment you buy or build in the 150 to 350 horsepower range and it's a sure bet that it's available—or will be soon—with the Series 500 TORQMATIC, *the world's most versatile torque converter.*

Scores of manufacturers—making such varied equipment as cranes, shovels, drilling rigs, log loaders, ditchers, industrial locomotives, scrapers, graders and off-highway trucks—specify the TORQMATIC 500 in the equipment they build, and with good reason.

In one standard housing it gives them a choice of 4 ranges, 7 torque ratios—*and* permits operators to standardize on *one* type of converter for *all* their equipment within the horsepower range.

In many applications it permits the use of lower horsepower engines with no reduction in *working* power because the TORQMATIC 500 multiplies engine torque anywhere from 250% to 360%—*and* means equipment owners will cut operating costs and get more work done per shift.

For full details on the Series 500 TORQMATIC Converter in your equipment write to:

Allison Division of General Motors
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GM TORQMATIC *Allison* TORQMATIC DRIVES

editorially speaking

Design and Maintenance are Partners

Remember the Model "T" days when with a couple of wrenches and a big hammer you could fix anything that went wrong? In case it's news, them days is gone forever. With today's four-barreled carburetors and automatic transmissions, there are modulators modulating modulators when modulated by another modulator. To fix them you must know the answers, have the instruments and tooling or you're just calling for Chloe in a dark swamp. This same sort of thing is happening in our industry. There's a good reason too. Today's demands for high performance and efficiency are met by concentrated engineering. And as you refine, any margin for error narrows. Fits get closer, settings more exact. Controls and accessory items are more complex to meet performance standards never dreamed of only a decade ago. Maintaining this improved breed of engine is not the simple chore it once was; it is exacting from both the performance and cost standpoints. It requires specific know-how, modern tools, and tops in supervision. There are healthy signs of progress on all fronts. To an ever-increasing degree engine builders are realizing that with the growing diesel engine population, their self-interest is best served by increasing the flow of maintenance data. You see evidence in stepped-up field training programs, more and better service literature, and attachment of increased importance to service departments and their personnel. On the users' side, the effect of maintenance on operating costs is being better understood. Better trained men, many graduate engineers, are in top supervisory spots. We see them at technical society meetings and at association conferences, as observers and also contributing sound technical data. Maintenance people are assuming full partnership with the design engineers. It had to come and will be mutually beneficial. And don't forget, the more constructive give-and-take that goes on, the better the balance sheets will look.

B P E

Sealed Power has a way with Chrome not duplicated by others

Here's how Sealed Power engineers have licked the heat, friction, abrasion, and corrosion caused by higher engine speeds in modern motors.

THE CASTING . . . For better bonding of the chrome face, Sealed Power developed a special chrome-alloy cast iron. Oil-carrying grooves are machined into the face of the casting for better lubrication.

THE PLATING . . . The chrome face is then electro-plated on the casting, to a thickness of not less than .004". Note that the oil-carrying grooves are still apparent. They are an important factor in the ring's success.

THE LAPPING . . . After plating, the ring is factory-lapped to a light-tight finish, which is equivalent to 300 to 500 miles of actual road wear. This expert lapping is the reason for the ring's quick seating.

In cases where exceptionally hard service is demanded, Sealed Power's exclusive Cyclan ring iron may be used for top compression rings, with the chrome plating added as illustrated here. Whatever your chrome ring problem, you are invited to use Sealed Power's long years of successful experience.

SEALED POWER CORPORATION • MUSKEGON, MICHIGAN • ST. JOHN'S, MICHIGAN • ROCHESTER, INDIANA
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Sealed Power Piston Rings

PISTONS • CYLINDER SLEEVES

Leading Manufacturer of Automotive and Industrial Piston Rings since 1911
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highlights

About 2000 annually is the nation's current off-highway vehicle market, with a valuation of $60 million. With implementation of the proposed road program, it could rise to 9000 vehicles. This big potential was a feature of sales promotion plans detailed to a meeting of Mack Truck reps.

Reciprocating engines are here to stay. So says Dr. Igor Sikorsky in relation to helicopters. Turbine and nuclear developments will not replace their economy or durability. Since this is true in the aircraft industry where gas turbines, jets, etc., have made the greatest headway, it must be even more significant in the diesel industry.

Fuel cost savings of about 30% are reported by J. E. Moran, port engineer, Mississippi Shipping Co. He told a "Marine Maintenance" panel at the Oil and Gas Power Div., ASME, conference in New Orleans about obtaining gross savings of 38% by using a blend of residual fuel and a small percentage of distillate. Maintenance costs increased 8%, to leave a 30% net gain in the operation of the company's ocean-going vessels.

Public concern over air pollution by internal combustion engines may soon force acceptance of "afterburner"-type exhaust units to complete combustion. Typical are Clayton's new burner-type muffler and Houdry's Oxy-Cat catalytic muffler which effectively reduce required combustion temperatures. Complaints involve eye-burning and odorous gases as well as smoke.

Unused storage tank is now research center for an oil company. It has a capacity of 80,000 barrels or 60 technicians. Claimed to be the first of its kind, the circular unit was faced with porcelain enamel and aluminum. It combines pilot area, research laboratories and high-pressure research all under one roof.

Boosting compression from Alberta to Vancouver will be 11 new Nordbergs. Just sold to West Coast Gas Transmission Co., Ltd., they'll be putting out 3550 hp apiece.

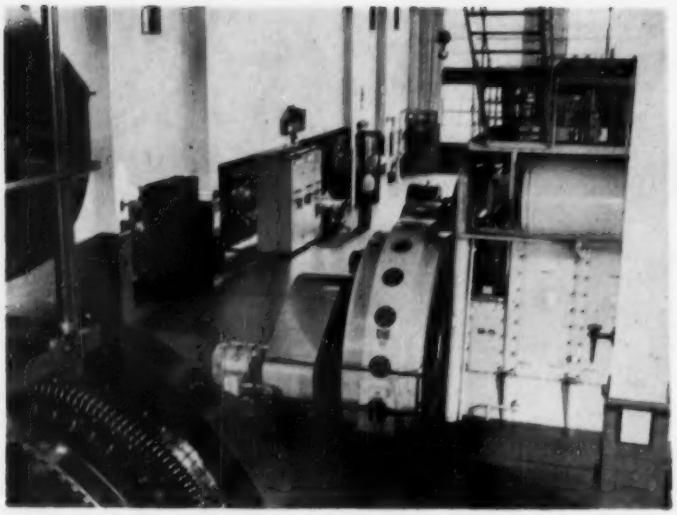
Diesel locomotive shipments for 1955 were almost double that of 1954, Alco Products, Inc. makes known in its annual report. Speaking of 1956, P. T. Egbert, president, expects sales of regular products (which include locos) to be even greater.

An electronic vibration reducer by RCA scientists can isolate vibrating machinery or cut down its vibration. It works by turning vibration against itself through a detecting and amplifying system. Response is either creation of an opposite force or absorption of the motion.

Cummins Turbodiesel shipments went up 85% in Dec. 1955 over the same month of the previous year. Deliveries were used in trucks, shovels, locomotives, earthmovers, logging, and oilfield operations, according to the Cummins 1955 report, with marine turbodiesels also winning widespread acceptance.

Aluminum dry cell batteries as good as zinc batteries are claimed by Alcoa's research labs. Former attempts to utilize aluminum properties (low electrochemical equivalent and high electrode potential) failed because of low shelf life of the cells. The new development has a long shelf life.

Free service for oil equipment inventors is maintained by the Southwest Research Institute and they are backed by the oil companies. The Institute will examine and write a report on any oil-finding process or device you submit.



Switch gear seen from platform of no. 5 engine. New dead-front control panel is being connected prior to being moved back to replace older live-front panel. New high-voltage switch gear is in another building.

Rockville Centre's Plant — A Case History

Exploring what's going on in Rockville Centre's Municipal Power Plant to see what factors contribute to a successful operation.

ROCKVILLE Centre's Municipal Power Plant is an ideal subject for a case history. There are so many interesting angles to explore. From its long and successful record of service to the community, you could pick a half dozen different doors to open in a search to see what makes it tick. The answer doesn't lie behind any one door; only a piece of it. So let's start opening "doors" and assembling enough of the pieces to get a pattern.

You could start out by opening the door marked "Planning" to see the basis of their operation. . . .

Rockville Centre got off on the right foot. History is perhaps important only for the lessons it teaches or for the purposes of comparison. So we'll have to touch on it here. From the first small generator, installed in 1898, the present power plant has evolved. The village also has its own water plant and sewage collection facilities.

Evidence of good planning and organization is shown in later grouping of these and other functions, plus the continuing setup for competent supervision. Harry Major, a civic-minded citizen and distinguished engineer, headed the light plant as chief engineer for 12 years and then assumed an added and similar responsibility for the water department for the next 20 years. It is significant that he was also commissioner in charge of these functions until his retirement in 1946.

At this time a Department of Public Utilities was formed and the sewage disposal plant was brought into the group. Charles P. Ketler, another professional engineer, took over as commissioner and chief engineer. The next step was to combine public works in the group under Mr. Ketler.

This setup permitted a continuity of planning to keep pace with the mushrooming business and population growth. In terms of electrical consumers, commercial accounts and kwh per account have both roughly doubled in the last decade. Residential accounts are up about 26% and usage per account is about double.

A 10-yr expansion program for added facilities is currently under way. A block-long area (roughly 600 ft by 200 ft) backed against the railroad embankment, has been

acquired. It currently includes the power plant and utilities building and is being developed on a phased program. It provides expansion room and facilities to meet the foreseeable growth in services required.

Continued service to any community requires this sort of planning; a freedom from harassment, political or otherwise; and people with both executive and technical ability to execute the plans. This is the first piece of our answer.

Now let's try the door marked "Power Plant". Here we'll find areas devoted to its physical aspects, its engineering concepts, and the operating phase. . . .

The plant went through the evolution from steam to diesel in 1927. Engine numbers tell the plant's history. No. 1 was an 850-hp, 4-cycle McIntosh & Seymour. Nos. 2 and 3 were similar units of 1250 hp each. These were the first engines and in 1930, a third 1250-hp unit (No. 4) was installed, giving a total of 4600 hp.

Now here's something to think about. These four engines occupied the whole original plant. They more than amortized themselves and are now gone. Today, Nos. 7, 8, 9, and 10 take up the same space. They are all Nordbergs—No. 7—300 hp; No. 8—3850 hp; Nos. 9 and 10—4500 hp each. What a commentary on the improvement in diesel engines through the years—15,850 hp in the space formerly required for 4600 hp! These engines, incidentally, were installed in 1941, 1950, and 1954 (Nos. 9 and 10), respectively.

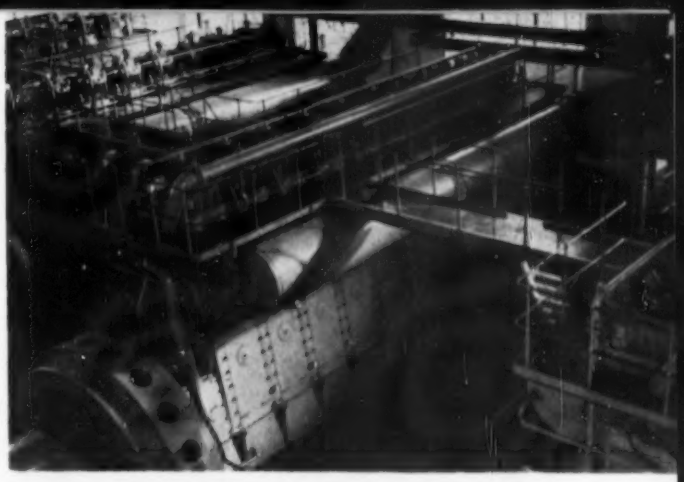
If the building had had to triple in size, it would have been up against an almost insurmountable land problem to say nothing of costs. But they did have to make some addition. Perhaps you've wondered what became of Nos. 5 and 6. They were installed in a plant extension in 1933 and 1937 and are still going strong.

At one time these were the largest 4-cycle engines in any American power plant. They are 2865-hp crosshead-type, air-injection McIntosh & Seymours. They still pull their load and with the Nordbergs bring the total horsepower up to 21,580 hp, 15,120 kw.

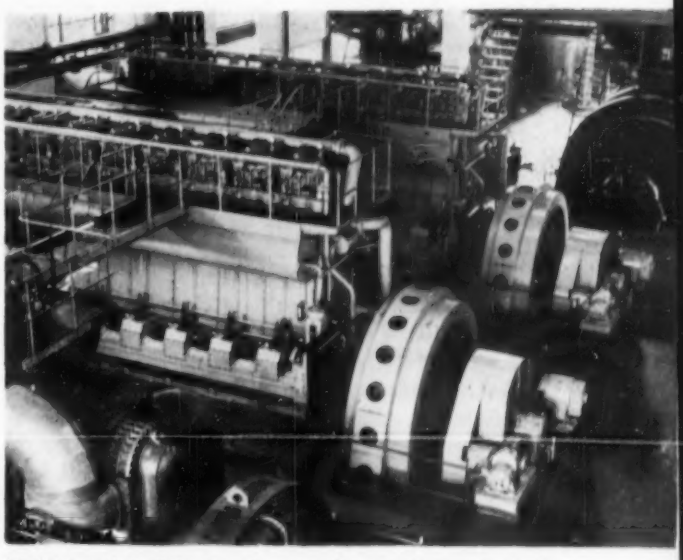
Future engines are anticipated as attested by the utilities area plan. Space is allocated for an addition to the plant and for larger fuel storage capacity.

Engineering concepts are aimed at taking advantage of the latest technology to do things better and at less cost. One place that you can see this is in the progression of engine systems. Take engine cooling, for example. There have been changes as each new engine was installed but let's take the extremes. You jump from an open to a closed cooling system.

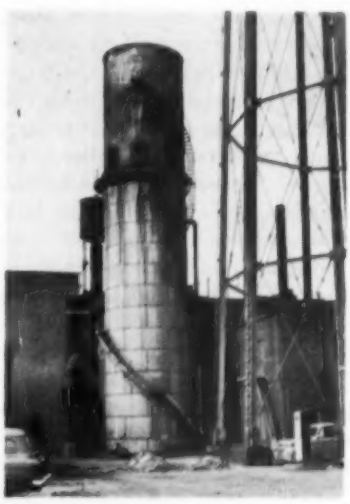
Rockville Centre has a unique cooling tower. The top of a 100-ft abandoned water standpipe was converted to an induced-draft tower by placing a fan in a shroud ring at the top, installation of redwood fill, and the cutting of louvres part-way down the tower. Don't get the idea that it was cobbled up; it was carefully designed to cool the original six engines. In fact, it was so well and conservatively designed that it is now handling the whole cooling load for the present engines.



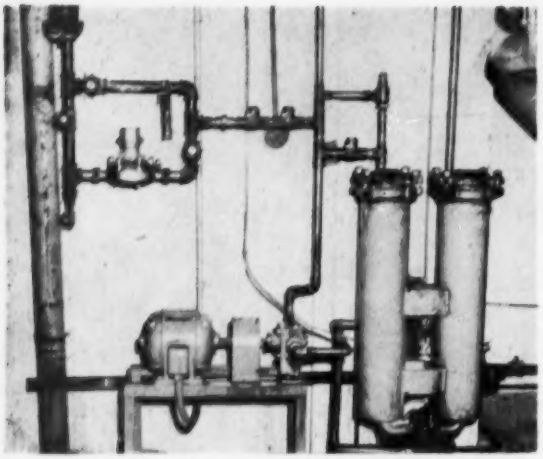
Nordberg engines nos. 7, 8, 9, and 10. Replacing four original engines, long since amortized, they supply 344% power in same space.



Nordberg engines. Note space for gas valve control pumps beside injection pumps for dual-fuel operation. Background, "Macs" nos. 5 & 6.



Induced draft system with shrouded fan and louvres has been fitted into standpipe.



Combined gravity and circulation fuel system provides an assured fuel supply to engine under any operating conditions. It eliminates need for day tanks. Flow and circulation are described in text.

The plant could get away with an open system because their own well water was soft and plentiful at only the cost of pumping. All but the two largest engines still use the open system. Riser pumps take the water from a hot well to the top of the tower. After cooling, flow is by gravity to the headers supplying the engines.

The two latest Nordbergs have closed systems. Both the treated jacket water and the lube oil are cooled in heat exchangers. The secondary or raw water circuit is supplied by water from the headers and after passing first through the lube oil cooler and then the jacket water cooler, centrifugal pumps lift it to the top of the tower for re-cooling. Thermostatic bypass valves maintain even lube and water temperatures.

Then let's look at the fuel system. An Esso No. 4 low-sulfur, 22 gravity oil is being burned at the rate of about 10,000 gal per day. It is roughly the same fuel that has been burned for years but as refinery cuts got deeper, its quality has suffered somewhat. Yet in the last decade, like everything else, its price is up about 75%. This has put a premium of operational efficiency but first let's talk about fuel handling in the plant.

Up until the installation of No. 7 in 1941, day tanks were customarily used. But day tanks present problems—as plant operators well know. For this engine a simple system of direct fuel supply was worked out and was used on all engines subsequently installed. It is a combined gravity and circulation system.

The system is illustrated. Fuel supplied by gravity flows down (left) through a strainer and to the meter. The meter can be bypassed if removal is necessary. Fuel then flows through two check valves to the juncture of the circulating return line and the supply line to the circulating pump. This pump pushes it through the filter and to the engine (line at far right). Returned fuel flows to pump suction.

A branch line between pump outlet and return line has a relief valve to protect the pump against excess pressure. A check valve in parallel with the relief valve provides for gravity fuel feed to the engine in case the pump is shut down.

This simple arrangement of valving, check valves, duplex filters, etc., provides an assured fuel supply to the engines under any conditions, and the circulating feature under all normal situation. As fuel is used from the circulating loop, it is made up by flow through the meter. Thus, the meter records only the fuel used.

Discussion of fuel systems brings up another engineering concept implemented when the last two engines were purchased. When natural gas was delivered to Long Island by pipeline, investigation of both costs and availability was made. Both indicated that its use was economically feasible and desirable, at the very least on a seasonal basis.

That's why engines Nos. 9 and 10 were ordered with gas systems on them including cams on the camshaft for the gas valve control pumps, necessary head openings, etc. Air cleaners and the centrifugal scavenging pumps were set up to permit automatic air throttling for better part-load efficiencies when gas was used. Even air precoolers were provided. Swingover to dual-fuel operation of these engines is expected in the summer of 1957.

Still another engineering project in the plant is a switch-over from a 2-phase, ungrounded, 2400-v system to 3-phase, grounded, 4160-v, wye system. While the incentive was supplied mainly by distribution problems, it had its effect on the plant as well. Loads were growing and distribution circuits were being taxed. By going to 3-phase power, increased distribution capacity could be obtained with the least investment in new wires.

Decision to go ahead was reflected in the ordering of 3-phase generators on Nos. 9 and 10 units. To utilize their capacity about 50% of the circuits are being converted. About three-quarters of the overhead wiring is done with some underground work still to go. It was also planned for eventual conversion of all units to 3-phase power, once the old Nos. 5 and 6 units had outlived their usefulness (they're about 20-yrs old now). Converter gear is on hand.

With this basic decision, a separate switchgear building was conceived. All high-voltage switchgear will eventually be in a separate building with only dead-front control panels in the engine building. In addition to updating all switchgear this action effectively separates the plant from the distribution system, a cable tunnel being the only link. From the Civil Defense and disaster angle, this has the advantage of permitting outside ties or auxiliary power to be fed into the distribution system should something happen to the plant.

A complicated checker game is going on in the plant. With a minimum of power interruption, circuits are moved to spare panels. Dead panels are then removed and a new one spotted in front of the space, giving access to its back. Then circuits are connected to the new control panel. The whole thing is then moved back into place with the cables being pulled back too.

This process is repeated for each panel in turn. Outage

during cutover is just under two hours and will be shaved to one hour with more experience.

As to operation, you have only to look at the plant to know that everything is under control. It is clean and painted, orderly, and its excellent crew always seems to be busy on some scheduled project. As to effectiveness, perhaps the kwh-per-gal curve is the best indication. It is to be expected that efficiency would increase as more modern engines were installed but the curve shows improvement even during interim periods.

Such gains are only attributable to better operation through engine adjustment and good maintenance. The chart shown is necessarily generalized; detailed yearly charts emphasize this efficiency trend.

Several refinements and innovations also point to good operation. A couple will be mentioned. One deals with the outside vents from the scraper ring drains on the engines and also lube oil tank vents. When these were vented directly to the atmosphere, the condensation or settling out of oil mists and vapors posed quite a cleanliness problem.

A simple separator of 10-in pipe was built in the shop. It was packed with stainless steel wool. Both drain compartments and tank vents are piped to the separator. Its effectiveness is evidenced by the substantial amount of separated oil.

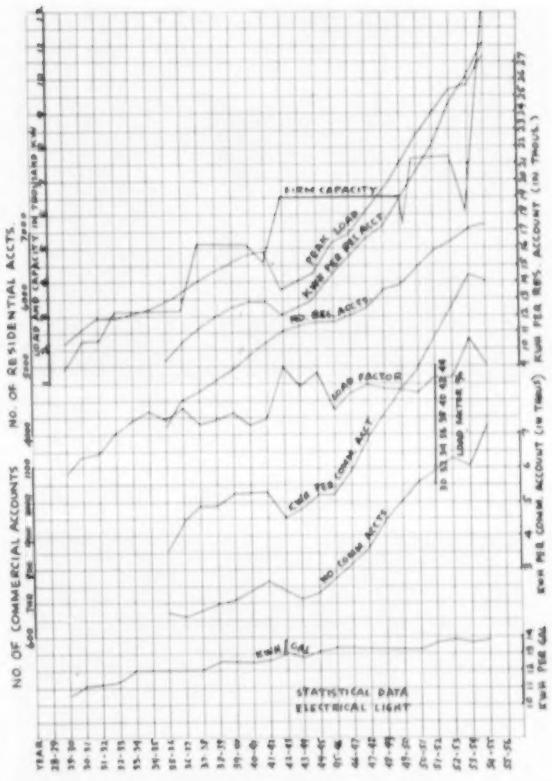
Another operational problem on which much has been done concerns silencers. All operators are familiar with the problems of rust and corrosion and also that of keeping preservative paints on them.

One approach was tried when engine No. 7 was installed. The silencer was placed in a masonry enclosure. This provided protection from the elements, improved the plant's appearance and also provided some waste heat recovery. A louver and blower near the floor of the plant connected with the enclosure. At the top there was a controllable vent that selectively discharged the air taken from the plant floor to the atmosphere during warm weather or delivered the heated air to the plant in cold weather.

While this setup did its job, there was a limit to the waste heat that could be used and the installation was expensive. The next approach was based on experience with different materials and gave the best overall results. In each case, special silencer materials were specified. Baffles were to be made of a low-alloy, high-strength steel such as U. S. Steel's "Cor-Ten" and shells made of wrought iron. Costs ran 10% to 12% more but life was substantially increased and no maintenance, not even painting, was needed. *Now let's open the door marked "Community Service" since in the final analysis this is the measure of the plant's success. . . .*

Any municipal project, whether it be electrical power supply, sewage disposal, water supply, or provision of parks and playgrounds, must be judged on the basis of service and its cost to the community. Rockville Centre's plant meets this criterion with flying colors.

"Service" is provided in a lot of ways, starting with dependable and low-cost power. Rates for electricity are below those in adjacent communities not having their own



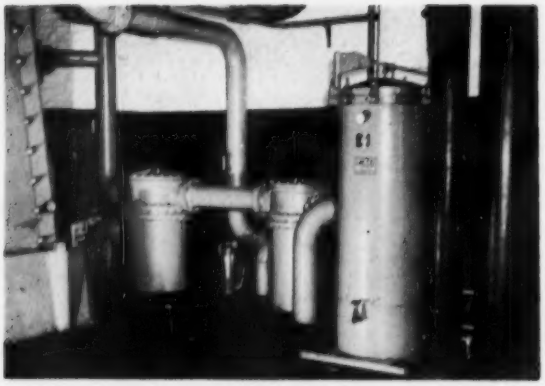
Composite chart gives thumbnail history of plant operation since 1928. Growth pattern indicates continual uptrend in fuel efficiency.

plants. Despite this, the plant is more than self-supporting and contributes substantial amounts to other community projects that otherwise would have to be sustained via the tax route. Incidentally, tax rates are one of the lowest in the area.

You can have low taxes if the community has nothing, but this is not the case here. It is one of the few villages in the area with sewers in and paid for; it has its own water system with the same rates as 40 years ago; street paving goes on continuously and 14 municipal parking lots are maintained; it has its own incinerator and sanitation service is provided.

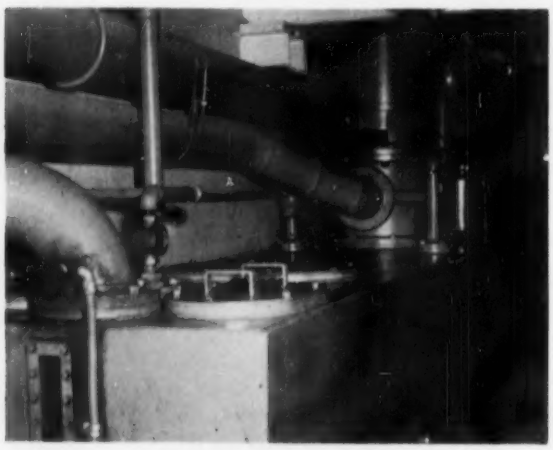
"White-Way" lighting on the main street (at plant expense) boosts merchants' sales. There are park areas and several athletic fields where Little League and other sports activities can take place. One field, partly on Lighting Company property, is floodlighted for semi-pro night games. These are a few of the things going on and still taxes are low. Figure it out.

There are other examples of service, too. Take the case where a tree knocks down some wires in a storm. When trouble is reported, a call goes out via 2-way radio to the nearest service truck to insure minimum outage time. The main station is at the plant and there are three remote stations. Plus this, some vehicles are equipped for unit-

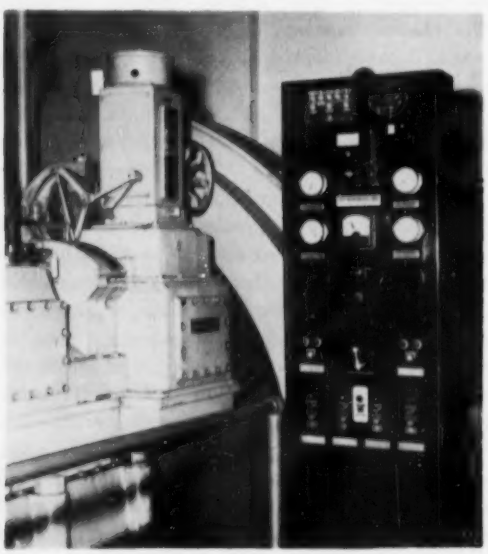


Jacket water and lube oil coolers use height instead of floor space. Tube bundles are pulled upward. Lube oil filter is by-pass arrangement.

Lube oil reservoir and oil pump. The pump is immersed in lube oil, which not only saves space; but minimizes wear on the pump parts.



Engine control and alarm panel. Governor "hat" is experimental generator-driven synchronous motor driving the governor. Effectiveness of frequency control is being compared to standard governor drive.



to-unit communication. This service extends to light, water, sewer and highway vehicles.

This network is also tied into the County's Civil Defense Headquarters. Should disaster strike, it is a supplementary means of communication. With the main station in the plant, no chance was taken that a signal would go unheard. A relay sensitive to radio frequency trips off a bell, louder than any noise level possible in the plant.

Another unique service is the "silent alarm". The village's distribution system is used to alert firemen in their homes in case of fire. An alarm unit in the fireman's home is plugged into a normal power receptacle. When someone pulls a fire alarm box, it starts a motor-generator set in the plant and starts transmitting the code in about five seconds. A perforated tape and air jet system is the repeating mechanism.

The result is that a 3800-cycle carrier current goes out over the distribution circuits. Wherever a receiver unit is plugged in, it responds and gets the fireman on his way. The system is positive, responding to as low as half a volt, and is relatively invulnerable to the elements.

After drawing a conclusion or two from these highlights of a progressive plant program, we'll open the door marked "Exit". . . .

An obvious conclusion is that this municipal plant is an asset to the community. Given favorable circumstances under which to operate and competent supervision, it provides benefits beyond its primary mission of supplying reasonably-priced, dependable power. It becomes an integrated part of community activity.

Another inference to be drawn from this case history is that plants must "grow" with the community, not only in size but in engineering and operational concepts. Increasing loads and the acquisition of newer, more powerful engines to meet them has the advantage of updating plant equipment. Use of modern, improved accessory items and the latest operational techniques are needed to exploit the potential advantages.

In short, it takes three things to make any plant, whether municipal or industrial, tick—Good men; good equipment; and circumstances that encourage the men to get the most out of the equipment.

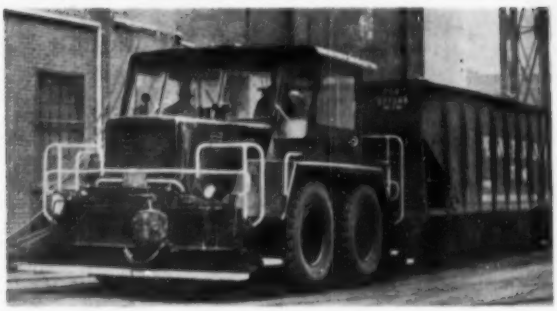
Equipment List for Engines Nos. 9 and 10

Engines	Nordberg Mfg. Co.
Generators	General Electric Co.
Cooling System	
Coolers	Ross Heat Exchanger Div.
Pumps	Allis-Chalmers Mfg. Co.
Thermostatic Control Valves	Fulton-Sylphon Div.
Lube Oil System	
Oil Used	#5 DTE, Socony-Mobil Oil Co., Inc.
Pumps	De Laval Steam Turbine Co.
Cooler	Ross Heat Exchanger Div.
Filter	The Hilliard Corp.
Associated Pump	Haight Co.
Lubricators	Manzel
Centrifuge (for batch cleaning)	The Sharples Corp.
Fuel System	
Filters	Wm. W. Nugent & Co., Inc.
Pumps	Haight Co.
Air System	
Filters	American Air Filter Co., Inc.
Scavenging Blower	Allis-Chalmers Mfg. Co.
Silencers	Maxim Silencer Co.

Free Moving "Switchmobile"

"Both ways forward" is done by pivoted controls which swing laterally from a center mount.

can
haul cars to form a train



or
cut across tracks and switches

or
haul cars around 50-ft radius curves

A NEW dimension has been added to railroad switching. The engineer crosses over tracks, drives across the yard, and might even enter the 5 o'clock traffic to take the shortest distance to pick up his next car.

Combining lightweight and power into a compact unit, a new rubber-tired "Switchmobile" has been put into service at Jersey City, N. J. by the Penna. Railroad.

Powered by a GM 6-71 diesel engine, rated 208-hp at 2000-rpm, Switchmobile develops approximately 30,000 ft lb of rimpull, or tractive effort. This is sufficient to move more than 1000 ton from a standing start, or pull up to eight loaded freight cars with ease.

Incorporated into the machine are many special features. The total length of the new switch engine is only slightly longer than that of a passenger automobile. A 4-speed transmission, with a separate lever for reversing, allows equal speed and power in either direction. A torque converter combined with the transmission provides smooth starts and an infinite number of speed ratios to transmit power equal to a 50-ton conventional engine.

To facilitate change of direction, the necessary operating apparatus is mounted on an arm which swings laterally from a central pedestal. After choosing direction the operator selects one of two identical bucket seats, facing in either direction and located on opposite sides of the cab. He then pulls the control arm before him. The window-enclosed cab allows all around visibility. Both steering and braking are accomplished with compressed air, which is also employed in braking the train.

To provide additional flexibility in coupling, couplers are on sliding mounts to allow right and left traversing. This permits the machine to haul cars around track curves as sharp as 50-ft in radius, and also too work easily in very close quarters. A wide wheel gauge permits track straddling without damage to the ties.

According to Merle R. Yontz, president of LeTourneau-Westinghouse, Switchmobile is soon to become a production item. Originally built on custom order, it will soon be available to railroads and industries all over the world.

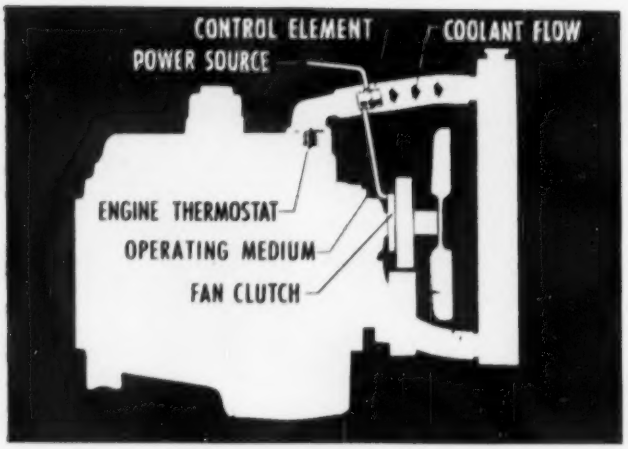


Fig. 1, shows three basic elements of temperature controlled fan. The control element, immersed in engine coolant, acts through actuating medium and fan clutch to drive fan when coolant reaches predetermined low temperature level.

Case for On-Off Engine Cooling Fan

AN engine cooling fan is a necessary evil. When you need it you really need it but when you don't it becomes a costly power-consuming parasite. Since the problem concerns any application where engine load and speed vary widely, fan power loss is a prime factor due to its effect on performance and fuel consumption. Therefore some sort of automatic on-off fan is definitely desirable in place of the positive-driven type.

Slowing down the fan or completely stopping it when it's not needed has been done for years on larger diesel engine installations. Separately driven fans on these installations can be run at low or high speed, or if necessary can be stopped when cooling water temperature is low enough. In addition fan blade pitch can be varied in some cases. Since application of these principles to automotive- and portable-type engines are just as important, if not more so, the following data refers specifically to vehicular engines.

what they are

An on-off fan is one which goes into operation the minute it's needed and stops immediately when it's no longer needed. This type of fan works when it's engaged to a driving member of the engine and stops when it's disengaged from this power take-off. The means of engaging and disengaging the fan must be sensitive to the cooling needs of the engine. This is the only way that efficient operation can be obtained.

what they can do for you

You can save a substantial amount of horsepower when the fan is not in operation. And in certain vehicular operations a fan may be needed only 5 to 8% of the time.

You can use the power saved for quicker acceleration, to travel at higher speeds, or for additional accessories.

If the extra horsepower isn't used you can lower fuel consumption by 3 to 10%.

You can have more quiet operation most of the time.

You can have faster engine warm-up resulting in reduction of lube oil sludging.

You can operate your engine in a stabilized and more favorable water temperature range.

You can have less engine wear and down time resulting from more favorable engine temperature condition.

You can have better over-all engine performance and efficiency because of more favorable operating temperature.

types available

There are two types of on-off fans—the automatic and the thermostatic. The automatic refers to the speed-sensitive type in which the fan cuts out at a pre-determined rpm. This type can't compensate for a condition such as high engine rpm and low vehicle speed which would exist when a truck was moving up-hill. In this case the speed-conscious fan wouldn't be in operation in spite of a need for fan cooling.

By working through a set speed range regardless of the engine's need for cooling, less power savings results with this type. For example there's a tendency to over-cool an engine during cold weather operation. Yet this type fan is simpler and cheaper than the thermostatic type and can be used in many applications.

Thermostatically-controlled fans being responsive only to engine temperature permit best operating temperatures at all times and require minimum power.

To provide a fan that will be driven only when high engine operating temperatures demand it, a 3-element device is generally needed. The first is a sending element that's sensitive to engine coolant temperatures. The second is an actuating medium to transmit the needs of the cooling system to the third element—a fan blade clutching device.

The control (or sending) element in the engine coolant acts through the actuating medium and fan clutch to drive the fan at a predetermined high temperature. It also acts to disengage the fan clutch and allow the fan blade to run freely at a predetermined low water temperature. This element must be installed at the highest coolant temperature point and have fast thermal response. The latter prevents overheating and possible loss of anti-freeze.

The actuating medium can be electricity, air, or a hydraulic fluid. This usually determines whether we call a fan an electric, air or hydraulic fan.

The fan clutching device is the heart of the system.

1. It must be light-weight.
2. It must be compact enough to fit in existing engine to radiator space.
3. It must be adaptable to available fan blades.
4. It must be powerful enough to transmit required horsepower.
5. It must be smooth and quiet during engagement.
6. It must release cleanly with no inherent drag.
7. It must run cool.
8. It must be rugged and reliable.

To facilitate discussion of the description and operation of various types of clutches used with these fans, specific types made by different manufacturers will be covered.

air controlled fan

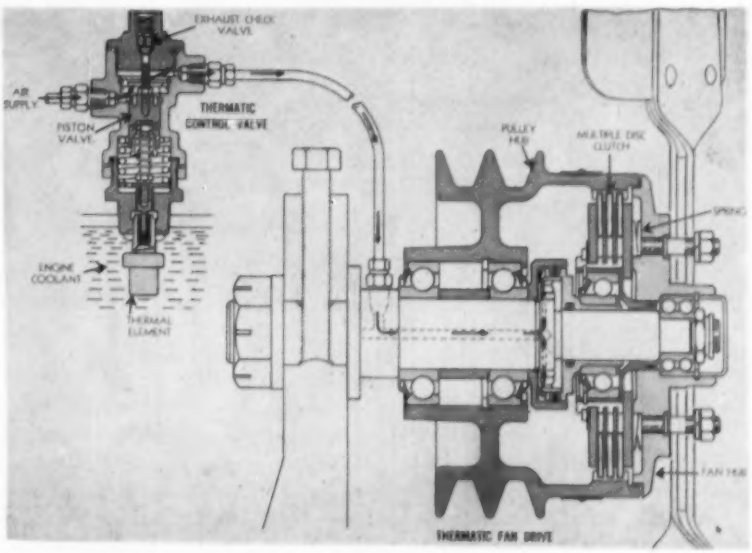


Fig. 2, shows Thermatic valve in contracted state permitting air pressure to act on Thermatic fan drive. This pressure disengages the multiple disc clutch allowing the fan hub assembly and the fan to idle.

An example of a clutch engaged and disengaged by air pressure is shown in the Bendix-Westinghouse Thermatic fan system. (Fig. 2) The system consists of two units, the Thermatic fan drive and the Thermatic control valve.

The Thermatic fan drive has a built-in multiple-disc clutch, normally engaged by spring pressure, turning the fan with the pulley. When cooling is not required, air pressure regulated at 72 psi by the Thermatic Control valve automatically disengages the fan.

When engine coolant falls below the desired operating

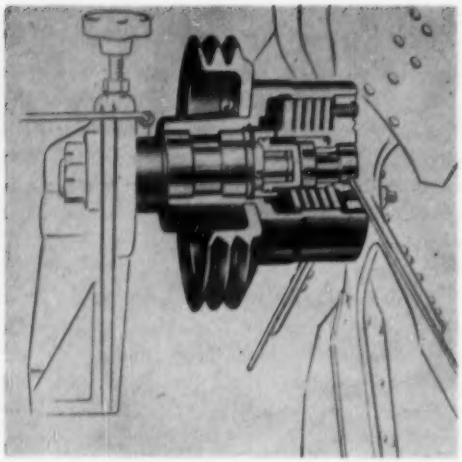


Fig. 3, shows Thermatic fan drive. Built-in multiple-disc clutch, engaged by spring turns fan with pulley.

temperature the thermal element of the Thermatic control valve is in a contracted position. It actuates the valve mechanism and allows air pressure to work on the Thermatic fan drive. This pressure disengages the multiple-disc clutch allowing the fan hub assembly and fan to idle. The pulley assembly continues to rotate but it's no longer driving the fan.

As the engine water temperature reaches the top limit of efficient engine operation the thermal element in the Thermatic control expands and actuates the valve mechanism. This automatically exhausts air from the fan drive and shuts off the air supply. As air pressure is released from the fan drive, a set of springs engage the multiple-disc clutch. This permits the fan hub assembly and fan to turn with the pulley assembly and again begin its cooling operation.

The Thermatic fan system is available in kits for field installation. It is designed for interchangeability with present constant fan drives making use of the standard fan, pulley and bracket.

Actuating force for the fan can also be engine oil pressure at 35 psi instead of air pressure from the basic air brake system. In either case the system provides for automatic fan engagement in case of loss of actuating pressure.

electrically controlled fan

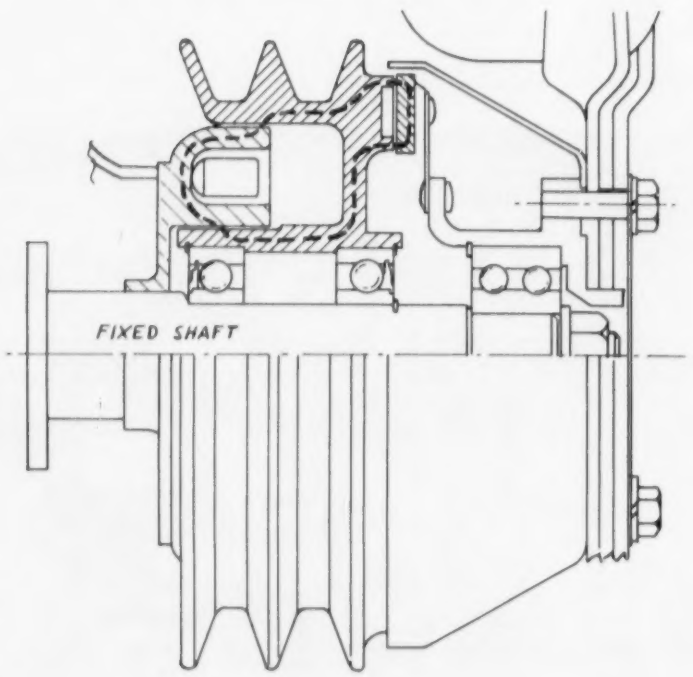


Fig. 4, shows how magnetic pull at rotor pole-faces attracts the armature and holds it to the moving rotor when coil is energized. The Hub and fan are then driven with pulley. Dashed line shows magnetic path.

To illustrate the electro-magnetic principle of operation let's use the Warner stationary-field clutch. This clutch made by Warner Electric Brake & Clutch Co., has been applied successfully to fan clutch use. It is called a stationary-field unit because the coil which supplies magnetic flux is a stationary part of the clutch assembly. This eliminates collector rings or brushholders since the field is connected directly to the power supply. The rotor revolves

concentric with the field and is fastened to the driven shaft. The armature is fastened to the driven fan and when the field is energized, the driven armature is attracted to the rotor driving the fan in full positive engagement.

One such stationary-field design has the field mounted on the water pump housing. Sheave and rotor are fastened together and mounted to drive the shaft continuously. In this way the water pump impeller is always rotating. A hub is mounted on bearings in front of the rotor with the armature fixed to the hub with leaf springs so it normally runs with a small clearance between its face and the rotor face. The fan is bolted to the front of the hub. When the coil is energized, magnetic pull at the rotor pole faces attracts the armature and holds it to the moving rotor. Hub and fan are then driven with the pulley.

Fig. 4 shows a similar stationary-field design for a fixed shaft in which the fan is driven and the water pump is located elsewhere.

Two basic types of controls are used to regulate this type fan clutch. One is a surface-mounted unit which fits on the radiator core and can be either a tube-expansion or disc-type switch. The other is a snap-acting, thermostatic immersion switch which is installed above the engine thermostat. This usually permits the fan to be engaged at 180°F water temperature and disengage below 170°F. But the switches can be set to different temperatures depending on the engine's most efficient operating temperatures.

Tests show that a switch mounted on the radiator permits a thermostat setting about 10°F lower than the desired water temperature in the block. This should be considered when selecting this arrangement.

hydraulically controlled fans

Fig. 6, shows thermostatic 2-way valve which controls oil from oil pump into coupling when fan cooling is required. Valve closes inlet port and opens outlet port allowing fluid coupling to empty by centrifugal action when the fan isn't needed.

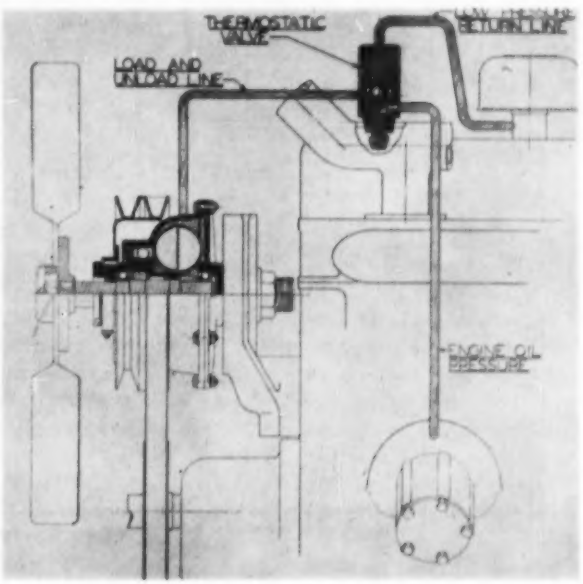
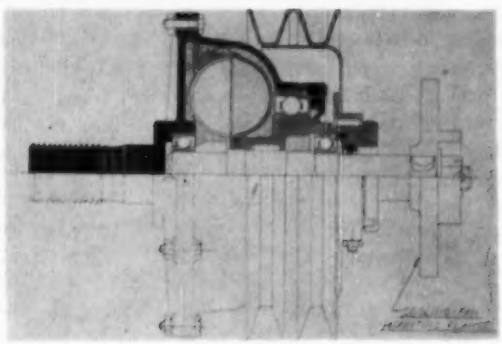


Fig. 5, shows fluid coupling located between fan blade and drive pulley. It consists of two torus members having 45 deg vanes. One member connects to fan and one to pulley.



Another method of engaging and disengaging the fan clutch is by use of a fluid coupling. One such coupling, (Fig. 5), developed by Thompson Products, Inc., is located between the fan blade and the drive pulley and consists of two torus members having 45 deg vanes. One member is connected directly to the fan blade and the other to the drive pulley.

The fan is turned by filling the coupling with engine oil. Emptying the unit disengages the fan member from the drive pulley. This control system has a thermostatically controlled 2-way valve, (Fig. 6), which controls oil flow from the engine oil pump into the coupling when fan cooling is required. When the fan isn't needed, the thermostatic valve simultaneously closes the inlet port and uncovers an outlet port allowing the fluid coupling to empty. The unit unloads by pumping the fluid out the rim by centrifugal action of the rotating coupling.

The torque transmitting characteristics of the coupling varies with the diameters of the torus members and the degree of fill.

In a refined version of the hydraulic coupling, (Fig. 7), the desirable characteristics of a fluid coupling are combined with a cone clutch to increase efficiency. This is done by making torus members with matching clutch faces.

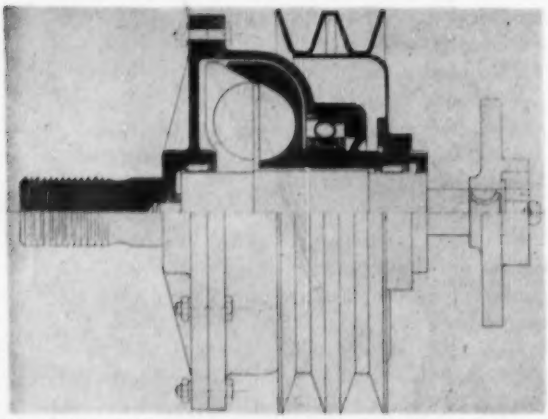


Fig. 7, shows fluid coupling combined with cone clutch. Oil pressure makes torus members move together and engage the cone clutch.

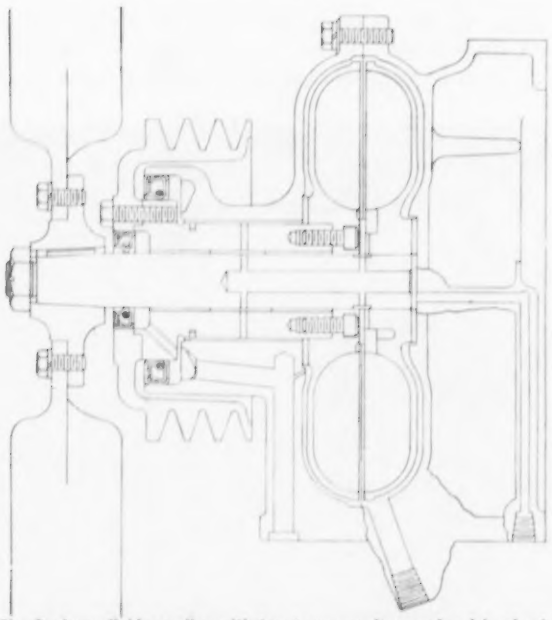


Fig. 8, shows fluid coupling with two torus members enclosed in aluminum housing. Oil is supplied to coupling center through an orifice..

variable-pitch fan

Prior to developing the hydraulic-type fan clutch, the GMC Truck and Coach Div. used belt-driven variable-pitch fans on some of their inter-city coaches. At present over 2700 fans of this type used on their coaches have accumulated more than 1/3 billion miles.

The fan consists of a two-piece housing in which are assembled six fan blades mounted on double row bearing assemblies as shown in Fig. 9. A bell crank and movable sleeve arrangement at the inner end of fan blade arms

As the unit begins to fill the torque is gradually applied to the fan driving member. Efficiency increases with the degree of fill. When the unit is filled the oil pressure acting on the differential areas of the torus members makes them move together and engage the cone clutch. This results in the torus members turning as a unit. Fan blade action also contributes to the clutch engaging pressure.

When fan cooling isn't needed, the outlet port is opened by the valve and fluid pressure is lowered in the coupling. This makes the torus members disengage and oil is pumped to the engine sump by centrifugal action.

Another example of a fan driven by a fluid coupling is that developed by the GMC Truck and Coach Div. of G.M. Corp. As seen in Fig. 8, two torus members are enclosed in an aluminum housing. Oil is continuously supplied to the center of the fluid coupling from the engine oil gallery through an orifice.

The amount of oil that is retained in the coupling is controlled by a thermostatic oil valve. This valve is actuated by cooling water returning to the engine from the radiator. Under cold conditions the valve is open, the oil returns to the crankcase and no power is transmitted to the fan.

When water from the radiator reaches a predetermined value the valve starts to close thus retaining oil in the housing and gradually transmitting power to the fan. The fan speed modulates with the amount of oil kept in the coupling as determined by the water temperature. Under steady operating conditions a heat balance results and the fan speed stabilizes.

The fan doesn't oscillate between "on" and "off", thus giving more gradual temperature changes and eliminating any shock loads on driving mechanisms. When water temperature drops, the thermostatic valve opens and the coupling dumps. The fan stops operating and the power absorbed is negligible.

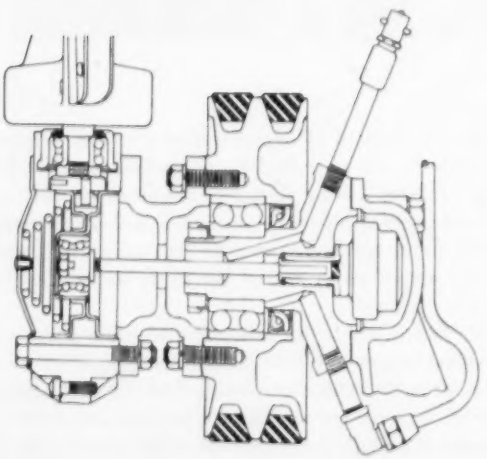


Fig. 9, shows a bell crank and movable sleeve arrangement at fan blade arms inner end for varying the fan blade pitch.

provides the mechanism for varying fan blade pitch.

The actuating mechanism consists of a sleeve which engages an actuating shoe on each blade assembly and a spring for blade return. Power for operating the actuating mechanism is provided by a thermostat installed in the fan pulley spindle. An adjustable push rod transmits movement from the thermostat to fan blades.

A water line from the water outlet manifold is directed into the fan thermostat chamber to control the blade. When the engine is cold the fan blades are adjusted to provide a slight reverse pitch. Consequently, no cold air is drawn through the radiator when a cold engine is started.

Warm air from the engine is forced through the radiator which provides faster warm-up and reduces any tendency to freeze. When the fan thermostat is heated to a temperature of 168°F, the push rod is forced toward the fan blade housing. It exerts a force against the thrust bearing and causes the fan blade pitch to increase to a maximum of 192°F. When the water temperature falls below 192°F the fan blade pitch is reduced.

results

Due to its design and low production, the initial cost of this mechanical-type, temperature-controlled fan was about 50 times that of the conventional blades which it replaced. But even at such a high price it was found to save from $1200 to $4000 in fuel cost per vehicle during the eight years life of the vehicle. These figures were cited and justified in an SAE paper on this subject.

Based on a minimum of 3% improvement in fuel consumption, let's see how this saving is figured. Inter-city coaches average about 15,000 miles per month, or 180,000 miles per year and use about 25,000-gal of fuel. At 3% savings, 750-gal less fuel would be burned per year. At 20 cents per gal, $150 would be saved per year. Average life expectancy of a coach being eight years, the resulting saving in fuel per vehicle is $1200. Figured at 10% improvement in fuel consumption, the amount saved under the same conditions would be $4000 per vehicle.

In addition, other factors such as faster engine warm-up and stabilized water temperature have been reported to contribute substantially to increasing engine overhaul periods from 65,000 miles to over 200,000 miles.

When the unit shown in Fig. 6, was installed on a truck tractor equipped with a 200-hp diesel engine, certain tests were made. The truck was operated by a commercial carrier between Detroit and Grand Rapids. Thompson Products Inc. reports that timing devices indicated fan cooling was required only 5% of the total engine running time. In service such as this savings as much as $3 per 24-hr period are possible with properly engineered installation.

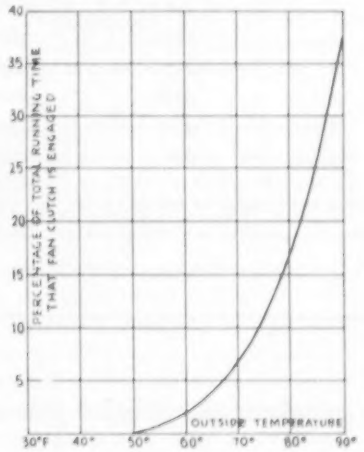


Fig. 10, shows percent of total time that fan was automatically engaged for various ambient outside temperatures.

Tests performed by Warner Electric Brake and Clutch Co. also show that average length of time of fan engagement is a small percent of the total. Averages for tests at all speeds including city driving are plotted in Fig. 10. The percent of the total time the fan was automatically engaged for various ambient temperatures is shown.

At temperatures below 50°F the fan was never required even for slow city driving. On days with higher temperatures the fan would occasionally engage while the engine idled. But in highway tests at 40 mph average the fan would never engage unless the temperature was above 70°F. Even on very warm days when the temperature was above 90°F the fan was engaged only 40% of the time.

in conclusion

The reduction of operating costs for heavy truck and coach operators is a prime factor. Thermostatically controlled fan drives of any type appear to offer substantial reduction in parasitic loss.

Realizing the need for such fan control devices, vehicle manufacturers and their suppliers working together and individually have produced units which because of lower cost, adaptability and reliability seem feasable for wide spread use.

However, even though initial cost is apparently high as compared to positive-driven fans, field experience definitely shows extensive savings in money resulting from less power loss as well as better engine performance and efficient operation.

But it's up to the individual operator to determine if his particular operation makes the added cost of the fan justifiable when weighed against possible horsepower and fuel savings.

TYPICAL PURCHASE ORDER

TO: Worthington Corporation
812 Race Street
Cincinnati, Ohio

CHARGE TO: UPSTATE CORPORATION
UPSTATE, USA

ORDER #667YL

DATE March 15, 1956

SHIP TO: SAME - NONSUCH, N. DAKOTA
VIA RAILWAY FREIGHT

The following parts per your quotation C-614-56 March 1, 1956

QUANTITY	PART NUMBER	NAME OF PART
1	#40	Felt Packing Rings
1	#46	Crankshaft Gear Key
6	#97	Tube for #96 and #96A
6	#97A	Rubber Ring for #96 and #96A
6	#97B	Washer for #96 and #96A
1	#48	Idler Gear Bushing

These parts required for 16" x 20" SEH engine No. VO-3183

Special Instructions: Prepay freight charges.

basic data

this will identify the order in later correspondence

ties order to earlier negotiation

Proper parts numbers and correct nomenclature pegged to a definite engine minimizes chance of error

saves confusion

You don't need a form to order parts: just type out order as shown, giving all important information. Get parts data from the proper manual, such as extract at right.

Is getting the right parts a matter of . . . .

ORDER or ORDEAL?

By J. A. Croes, Worthington Corp.

Looking for a way to reduce overhead costs and cut down-time? If getting the right part at the right time is part of your problem—and it could well be—here are one engine builder's tips on how to minimize delays and save yourself time and money.

ENGINES are individuals. Even though presumably duplicates, the newest engine will often incorporate improvements in structural materials, accessories or auxiliaries. These might include such items as fuel injection equipment, lube oil systems, superchargers or safety devices. Each change requires correlation with engine serial numbers.

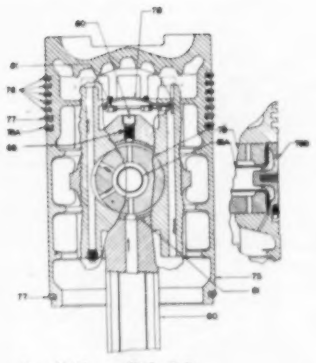
To avert error in furnishing correct parts and accurate information for any engine, manufacturers have established systematized procedures which seldom fail to deliver the correct material—*if*—the purchaser follows his part of the procedure as recommended by the manufacturer. The key to these systems are engine serial numbers and parts numbers.

During manufacture each engine is assigned a serial number which becomes the basis of its historical record. When parts are ordered, a record is made under the engine serial number at the factory. Part numbers are assigned to simplify the identification and ordering of parts. It's the manufacturer's job to supply the necessary parts books and the purchaser's responsibility to see that he has the right ones for his equipment and use them effectively.

Parts so ordered are usually tagged before shipment. Then, parts ordered by correct part number but incorrectly furnished are chargeable to the supplier. Otherwise, there is a basis for argument.

Part Numbers are "Universal" and Important

American-made diesel engines are used in many foreign lands. Parts lists are usually furnished in the native language for export shipments. This minimizes the sometimes amusing though often expensive confusion resulting



X - 165437 FIG. 2C

LIST OF PARTS

60	Connecting Rod
61	Connecting Rod Bushing
68	Special Bushing Screw
75	Piston
76	Piston Rings
76A	Ventilated Ring
77	Scraper Ring
78	Plate
79	Wrist Pin
79	Wrist Pin
79B	Plug with Screws
80	Special Tap Bolt
81	Lock Washer
81A	Sleeve for Wrist Pin #79
82	Key for Wrist Pin(not shown)

When ordering parts, always state SIZE and SERIAL NUMBER of engine, PART NUMBER, FIGURE NUMBER and QUANTITY wanted.

from language differences. Iscole, the Eskimo, perhaps cannot phrase an adequate description of a turbocharger in his own language. But he can indicate part "#SC-6567 (supercharger rotor-complete)" and unfailingly get what he wants without drawing a picture and all through using the parts list correctly.

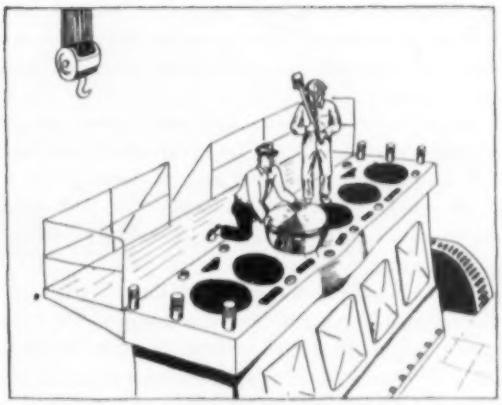
Shortly after World War II, several old engines were offered for auction when declared surplus. During manufacture, the engines had been consigned to an equipment "pool" for reasons of security. The assigned equipment numbers bore no relation to the actual serial numbers and the manufacturer's nameplates bearing serial numbers and other engine data were removed.

During the intervening years, these engines, used at several locations, were finally shipped to the ultimate destination, run for a short time and then "moth-balled". Somehow the owner's records were lost. Perhaps the questionable condition of the engines was to blame but their uncertain identity discouraged higher bidding and they were sold at junk prices.

The successful bidder resorted to considerable research to obtain the engine serial numbers. They were resold for a good profit when he assured the ultimate buyer that parts for these engines, with serial numbers, were available. Here's a dollars-and-cents example of the importance of serial and parts numbers.

Correct Parts and Procedures Cut Costs

Cost-conscious plant operators are trying to lop mils off costs for fuels and lubricants. Accurate fuel injector settings, equal cylinder loading, correct timing and precision setting of similar adjustments are essential if operating costs are to be shaved or even maintained. Modern high-output engines as compared to early lower-output models are relatively more critical to the exactness of adjustment if their potential high efficiency is to be obtained.



Tap it again, Alfie, she fits a bit snug.

This accounts for some of the noted decline in the "do-it-yourself-movement" as operators are reluctant to make engine parts or unprescribed changes. Recommended clearances, settings, temperatures, pressures, desired fuel and lubricating oil characteristics are only a few of the subjects covered in today's Engine Operating Instruction Books. Complying with the recommended procedures is difficult or impossible unless parts of correct dimensions and materials are used.

Furthermore, the engine can be expected to operate at lower efficiency. And it isn't likely that the engine manufacturer would feel obligated if poor performance or engine damage resulted from parts or procedures not recommended. So get the right parts the first time.

The typical diesel engine installation incorporates a good deal of equipment in addition to the engine itself and the operator should refer to the specific parts list and instruction book when ordering parts for this equipment too. This applies when ordering parts, making adjustments

Maybe we better read the instructions next time, Joe.

or changes in any of this equipment. Correct parts and unit serial numbers of the engine as well as the auxiliary item are essential when obtaining parts or requesting information.

Recently, we received a customer's order for parts to rebuild a fuel oil transfer pump furnished with an engine sold in 1928. The customer had the foresight to include serial numbers and model numbers for both pump and engine. We were thus able to recommend a more efficient pump, saving his time and money.

To avoid deterioration and confusion after receipt, spare parts should be properly stored and tagged. Parts lists and instruction books should be kept in a safe *but not secret* place. Otherwise, they might be lost for practical purposes when the custodian is unavailable.

Use Order Numbers

Information requests or tracers on order status can be handled most expeditiously when complete order identification is included. The purchaser's order number and the supplier's order numbers should both be given. Systematic, numbered orders minimize errors and reduce expense, being easily traceable by any means of communication. Some purchasers don't have an order numbering system. This invites confusion, especially when several orders are in process with the same supplier.

The following telegram was received recently from a company not using order numbers:

> "Refer our order Jan. 20 parts engine #7677 and 7676, also order Jan. 23 parts engine #137652-Y. Ship parts for #7677 air express except generator parts. Cancel third item cylinder liners order Jan. 20 engine #7676, ship balance motor freight. Add fuel injector nozzles our Jan. 23 order engine #137652-Y, ship air express, balance of order motor freight. Part shipments acceptable. Wire schedule all items."

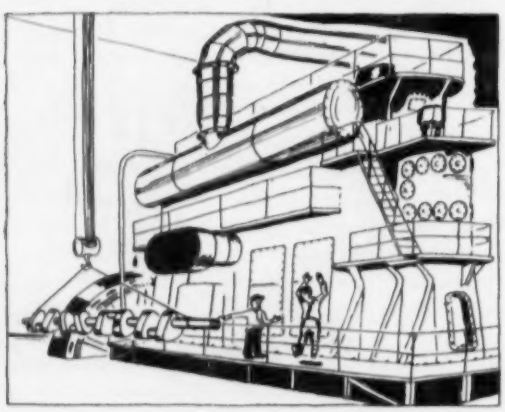
This inquiry can be shortened to the following by using numbered orders, a different order number for the parts of each engine.

> "Air express our order #1370 except generator parts. Cancel cylinder part #37L liners order #1371.
>
> Add fuel injector nozzles part #61F1 order 1372 ship nozzles part 592N air express. Ship balance all orders motor freight. Wire schedule all orders."

The reply to the first telegram was also longer than it would have been had the purchaser used order numbers.

It isn't necessary to keep an elaborate order numbering system in every case. Several concerns making infrequent purchases employ codes which do not depend on record keeping. One operator we know uses the year, month and date as his basis. Material ordered January 20, 1956 (1-20-56) bears order #56120 followed by A, B, C,—etc. to differentiate between orders placed the same day. He experiences no difficulty when checking with suppliers on the status of his orders.

Well, didn't you tell me to order a whole new crankshaft?



Charlie, I'm beginning to think those parts we found in the warehouse don't belong—.

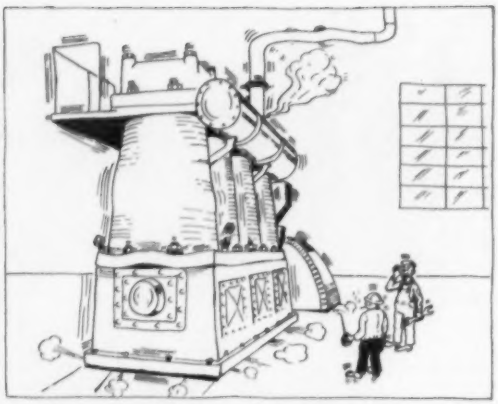


Figure on Returns Too

Returned apparatus (or material) systems are really part of ordering procedure because credit for material ordered is usually concerned. To assure prompt action (RA) Returned Apparatus Tags should be used. They positively identify incoming shipments assuring prompt action on requests for credit or advice. Understandably, material received without such identification is sometimes lost in a receiving room crowded with other improperly identified parts.

Materials bearing RA tags receive first attention because the necessary preliminary agreements covering conditions under which material is to be received were completed prior to shipment. Sometimes unauthorized (no RA tag) materials returned to the manufacturer are of less value than the freight charges. This waste can often be precluded by the correspondence which precedes the issue of an RA tag.

To Sum Up

Systematically planned orders are as superior to the other type as radio is to smoke signals. Success of these systems depends on the use of correct serial, parts and order numbers. If you have been seeking means to reduce overhead costs, has this one been overlooked? The potential savings invite a second look.

Saving the Engine During Storage

Inoperative engines gum and corrode at a faster rate. It can be very expensive. Before shutting your engine down, here are a few ideas.

LETTING a diesel engine sit idle can deteriorate it faster than using it properly every day. Removing an engine from operation requires more than just shutting it down. Special attention must be given to protecting it from rust and corrosion. Unless you prepare your engine carefully, you may find it costs you more to turn it off then it did to run it. Preventive maintenance is neither complicated nor involved; but it repays handsomely.

The same principles of preservation apply to diesels as apply to any engine. In the course of normal operation residues of various combustion products, such as gum and sulphur, accumulate in the combustion area and lubricating oil. Portions of these residues combine with atmospheric moisture to form corrosive compounds. These are the things that do the damage. Each system and component of the engine requires special and particular steps on your part to protect your engine.

Engine Exterior

First, engine must be free of all dust and dirt. You will be working on it, exposing and removing parts. Loose dirt that drops into engine openings will cause trouble at a later time. Clean the surface with fuel oil and wipe or blow it dry. Protect all exposed parts, especially the ferrous sections, with a thin coat of commercial rust preventative. All engine openings should be sealed tightly with a covering of a waterproof and vapor-proof material. Strong enough not only to resist puncture, it must also resist damage due to expansion of entrapped air.

Lubricating System

To help reduce damage from this source, immediately prior to shutting down the engine, run it up to operating temperature and drain the oil. Refill the case with preservative oil, or with lube oil of the proper grade to which inhibitive-type preservative oil has been added. Remove the valve covers and pour some of this oil over the rocker arms and valve mechanism as insurance that they are kept free from gum.

In some instances, however, it is recommended to change the lube oil and renew the oil filter element without the addition of any preservative oil or additive. On this point it is well to check the service manual for your particular engine. At least one major engine manufacturer recommends this practice rather than the former.

Combustion Chamber

Rust-proofing combustion chambers of diesel engines requires special consideration. Begin by removing the injector (on engines equipped with a glow plug you may remove this, if you prefer) and spray a small amount of preservative oil into each combustion chamber. Be certain the oil is well atomized so as to reach the valves and cylinder walls.

Never attempt to introduce preservative oil into the intake system with engine running. A runaway engine will result. For the same reason, when you restart the engine be certain all traces of this oil are removed from the inlet passages, manifolds and chambers.

If possible, turn engine occasionally by hand one or two turns about once each month of storage. This helps

prevent seizure of water pump seals. It is best to add some preservative oil to each cylinder after turning, as some types of oil are not suited to engine rotation. They scrape off the cylinder walls and leave them unprotected. This is not true of all preservative oils; but before rotating the engine the operator should investigate the characteristics of the oil used.

Fuel System

Fuel system preparation consists of servicing the fuel tank, the fuel lines and the injection system. If the engine is to be laid up for any length of time (30 days or more) drain the fuel tank and replace the fuel oil with several gallons of rust preventative. Renew the strainer and filter element and run the engine on this oil for several minutes at medium speed with no load. Leave the remainder in the tank. For short storage it is sufficient to fill the tank completely with fuel oil and run the engine a few minutes at high rpm.

Injection equipment requires more specialized attention. Unless it is properly protected from gumming and corrosion during storage periods, pumps, lines and injectors themselves are subject to damage while idle for more than just a few days. A flushing mixture, for example one part water-white kerosene and one part flushing oil, will be of great assistance in preventing harm.

Disconnect the main fuel supply line, and after wiping the end clean place it in a container filled with flush solution. Run the engine until nearly all has been pulled into the system. If this is the run with the preservative oil in the crankcase, make this the final engine run.

Running flush solution through the engine will ordinarily protect the injectors for short periods of time, up to several months. The protection period depends on the climatic and storage conditions. If engine is to be laid up under severe storage conditions, additional steps are advised.

For long term storage, or storage under adverse conditions, remove the injectors from the engine. Install shipping caps if you can, as they are probably best. If you cannot, seal injector openings in heads with wooden plugs or tape. Tape over fuel line outlets and injector connection fittings.

All injector lines should be carefully sealed at each end. Taping is satisfactory if a small piece of paper or foil covers the line before tape is applied. This prevents any remaining fuel in the line from softening the tape adhesive. Loosened adhesive might ooze down the line and later be carried to injectors.

Examination of injectors, after removing them from the engine, may reveal a coating of carbon over portions of the nozzles. Clean injectors by brushing lightly with a soft, brass wire brush, using care not to mar the small openings. Coat them with a thin layer of petroleum jelly or oil and wrap them in waxed paper. Store them in a dry place.

Remember that running flushing oil through the injector system will protect only the parts that it contacts. Some parts will be lubricated by the preservative in the crankcase; but be certain that all parts are treated.

Transmission

Moving parts other than the actual engine need protection, too. Gear box should be drained, flushed with fuel oil and refilled with fresh lubricant. Power takeoff main bearing and clutch-release sleeve bearing require high-grade short-fibre ball bearing grease, applied with a grease gun. Lubricate the sleeve bearing sparingly, or you will force grease onto the plates of the clutch.

Cooling System

If engine is going to be stored for only a short time it is permissable to leave the water in the system. Attention should be given to the condition of the water, as permitting it to settle will expedite rust formation. Add effective inhibitors. Also, if freezing weather is expected add anti-freeze in the proper proportion.

For longer storage periods it is best to drain the water. Leave all drain cocks open. Engine should be fitted with a tag, indicating that water has been drained. This will prevent accidental starting of the engine without coolant.

Engine Components

Remove the storage battery from the engine. Be certain it is filled with distilled water and fully charged. If it is not to full-capacity, recharge it and store it in a dry place in which temperature is always above freezing.

If the battery is going to be unused for any length of time, it is recommended to place it on a trickle-charger. An inactive battery will soon lose its charge, and serious damage will occur.

Clean the air cleaner now. Dirty oil will not only form acids during settling; but there is the possibility that it will be overlooked when the engine is again prepared for service. This is true whether yours is of oil-bath, or viscuous impingement type. On dry type filters, check the filtering media to be sure it is still free and clean.

Relieve the tension on all belts. Stretching a belt tightly

without the working action of normal use will make it deteriorate quickly. This may cause a shutdown when you least expect it. A strip of grease-proof paper between each vee-belt and its pulley will prevent the bonding of the two.

Preservative Equipment and Materials

Many times it is necessary to protect an engine for storage under difficult field conditions. A few simple tools will be a big help. A manually-operated spray gun, ordinarily used to lubricate inaccessible spots on automotive and truck chassis will atomize preservative oil and force it into manifolds and combustion chambers. Another is a hand-operated pump-type sprayer with a pointed discharge nozzle, commonly used to spray insecticide. A small oil pump may even be rigged with a motor drive to make a mechanical-type pressure sprayer. In most instances air from shop compressors is too moisture-laden to be safe for this purpose. Do not use it.

Compounds

There are many very good preservative and flushing compounds available—too many to name any specific ones. Generally, the qualities that make a flushing oil suitable are good aging stability; high resistance to gumming, oxidation and polymerization; low pour point and viscosity; freedom from acids, asphalts, resins, tars and water.

Preservative compounds are sometimes more effective if applied hot. It reduces their viscosity and gains penetration into inaccessible areas. Just as important, the hot compound reduces the moisture film of the metal surface. This avoids trapping moisture under the protective layer.

Generally, such heating is limited to 200°F or less. Direct heating presents a dangerous fire hazard, and it is safer to heat the preservative indirectly. This is done best by placing the container in heated water.

Preparing Engine for Operation

Steps required to bring an engine back into service are roughly the same as those normally carried out on a new engine. These are general inspection, checking for free rotation, refilling with water or anti-freeze, and checking for ample oil and proper adjustment.

Accumulated dust and dirt should be removed from engine immediately, especially around covers. Removing a cover will expose sections to loosened dirt which may drop in.

Engines not recently rotated should be oiled through the combustion chamber and cranked, either by hand or starter. This should be done before any attempt is made to start the engine. Rust and corrosion can cause seizure that will damage the engine if you try to force it clear.

Never attempt to start a diesel engine that has been stored without first cranking it with the injectors out. If oil, water or preservative compound spurts from the openings continue cranking until liquid no longer ejects. The spurting indicated a potential hydraulic lock that might have broken a piston or bent a rod if engine were forced to turn. Excessive water might indicate other trouble.

The last step is to check the intake passages and manifolds for thickened preservative oil. This kind of accumulation will melt when the engine gets warm, causing a runaway.

So if your engine is going to be out of service for a while, give it the protection it needs to serve you when you will once again need it. A little thought will save you the time and expense of repairing damage you could easily have prevented.

What Do You Know!

Here are some questions to test your general knowledge of the diesel field. Make your selections, then turn to Page 99 to check them.

1. Constant output shaft speed, regardless of engine speed or load fluctuation, is often desirable on diesels with torque converters.
   a. True b. False

2. Based on today's formula for forecasting future municipal power plant loads, the total capacity generated in 10 years from now will:
   a. Be about 1½ times present load.
   b. Double itself.
   c. Triple itself.

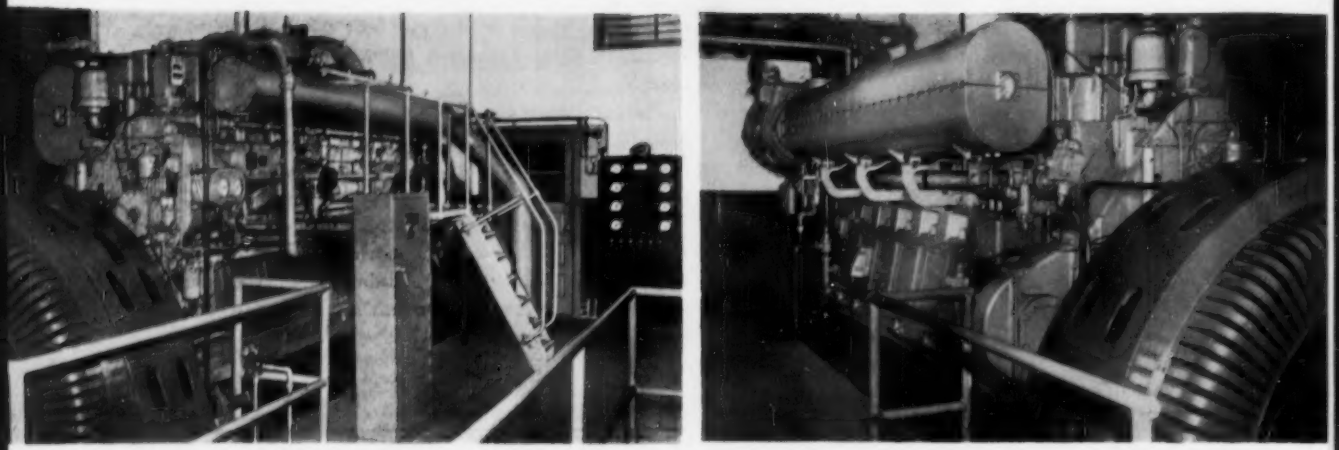
3. When rust-proofing combustion chambers of diesel engines prior to storage, the easiest and best way of getting the preservative oil to reach the valves and cylinder walls is to:
   a. Remove the cylinder head and spray or brush on the preservative.
   b. Introduce preservative into the intake system while the engine is running.
   c. Spray preservative through the injector or glow plug holes.

4. Never turn the engine over by hand during storage period since preservative will be scraped off the cylinder walls and leave them unprotected.
   a. True b. False

5. Letting a diesel engine sit idle can deteriorate it faster than using it properly every day.
   a. True b. False

6. Tests with vehicular engines show that a cooling fan is usually needed only less than:
   a. 25% of the time.
   b. 50% of the time.
   c. 75% of the time.

7. If the extra horsepower which is gained by cutting out a vehicular engine cooling fan is not used for anything else, fuel consumption can be lowered by as much as:
   a. 5%.
   b. 10%.
   c. 15%.



Addition of 1700-hp Cooper-Bessemer supercharged gas-diesel engine, placing older engine to standby, answered peak-load problem economically.

Lake Crystal Plant Expands & Upgrades

By **Vic Peterson,** Superintendent, Village of Lake Crystal, Minn.

Installation of modern engines can provide two advantages—increased plant capacity and the benefits of modern technology for more efficient operation.

OBSOLESCENCE of machinery is occurring at a very rapid rate today in numerous small municipal plants. Considerable reappraisal is therefore being made of power generating equipment to meet both present and projected demands. The experience of Lake Crystal, Minn., diesel power plant offers guidance to the direction that plant expansions can take in fulfilling future demands in the most economical manner.

Plans for adding generating capacity to this plant were initiated in the summer of 1954. The total plant facilities of 1710 hp was made of 3 engines; 300 hp, 450 hp and 960 hp, each of which was a non-supercharged design.

Some Problems Encountered

Some of the major decisions to be made were in relation to providing for peak loads and plant relocation. As far as the relocation problem was concerned, since the existing plant was built in the central business district and on sub-aqueous soil which transmitted vibrations, consideration was given to moving the plant to less crowded location. However, the cost of such a major move did not seem justified if the problem of providing additional generating capacity could be worked out some other way.

Now for the peaking problem. Lake Crystal, Minn., is an agricultural community with a population of approximately 1600. The industry consists largely of a milk drying plant, two feed mills and a seed drying plant. The seed drying plant is a highly seasonal operation. And during a 60-day period in the fall this plant required 150- to 200-kw.

The peak load for Lake Crystal during the seed drying period of September, 1955, was 815-kw. The winter peak load in December is 750-kw, while the average load in fall and winter months is 435-kw.

Further study of the power problem showed the desirability of replacing one of the existing engines, the 300-hp unit, with an engine of approximately 1400 hp to avoid construction of an extension to the existing plant.

The problem of a plant extension was then surveyed. The conclusion was that if the addition could be made at a reasonable cost the 300-hp engine could be retained as a standby unit. With receipt of favorable bids it was decided to extend the plant with a wing in back and buy a 1700-hp engine.

Construction of an adequate foundation to eliminate complaints of vibration transmitted to neighboring buildings was a prime factor. In the modification of the station, vibration problems were overcome by using piling to carry loading on firm soil 27 ft below ground level. Another nuisance, the noise level from exhaust and intake was reduced to below that of the fan from the radiators.

Supercharged Gas-Diesel Purchased

The 1700-hp unit purchased is a Cooper-Bessemer, supercharged, high-output, gas-diesel engine turning at 514 rpm. This engine has now been in service since the summer of 1955 and has shown its ability to handle fluctuations in load demands with high economies in fuel consumption.

At first it seems a 1200-kw unit with its 1700-hp, 155-bmep engine is an undesirable situation. The operating record of this engine, on the other hand, demonstrates what can be done with such a power unit. For, although the supercharged gas-diesel unit ran at less than 37% load capacity, fuel consumption for September and October were 10,350 and 11,650 btu per kw respectively.

The following operating record gives detailed costs of operation for September, October, November and December, 1955, for gas, diesel oil and lubricating oil.

Operating Record Fourth Quarter 1955

Cooper-Bessemer JSA-8-GDT	Sept.	Oct.	Nov.	Dec.
Engine hp hr	1,096,500	933,300	817,700	1,077,800
Hours engine run	645	549	481	634
KW generated	282,000	237,000	214,000	287,000
Running capacity factor %	36.7	36.3	37	37.4
Average kw per hr	437	431.7	445.59	452.61
Gal pilot oil (143,000 btu)	3230	2680	2130	**3380
KW per gal pilot oil*	87.3	88.43	100.46	85.0
Cu ft gas (950 btu lhv)	2,589,000	2,507,000	2,238,000	2,916,000
Cu ft. gas per kw*	9.18	10.57	10.45	10.51
BTU per kw	10,350	11,650	11,400	11,320
% pilot oil*	18.6	16.1	12.5	17.5
Peak Load kw	815	750	750	750
Pilot oil cost— 11.7¢/gal	$374.68	$318.82	$247.08	$392.08
Cost of gas (27.4¢/M)	$709.39	$686.92	$603.21	$798.98
Cost of lube oil	95.58	63.72	63.72	95.58
Total Cost	1199.65	1069.56	914.01	1268.64
Cost per kw	.00425	.00451	.00427	.00448
Cost per kw fuel only	.00385	.00415	.00399	.00415
Gal lube oil	162	108	108	162
HP hr per gal	6768	8641	7600	6650
KW hr per gal	1740	2194	1980	1770

*These figures inaccurate as engine run for periods as diesel to clean nozzles. This practice to be discontinued.
**Ran 21½ hours straight diesel when gas curtailed.

The figures given are for gas-diesel (dual-fuel) operation. Comparable results would be obtained on full oil operation. With gas-diesel operation, fuel oil is used for pilot ignition purposes and the engine runs principally on natural gas for fuel. Should gas be completely cut off, the engine operates as a straight diesel to assure continuous, uninterrupted service.

The corresponding costs for fuel shown in the operating chart are most favorable for this type of operation. During September it should be noted that the engine ran 24-hr a day for a large part of the month at low load factor.

It was also run for a period of time on starting up and shutting down as a straight diesel engine for the purpose of cleaning the nozzles. This cleaning process is not necessary and is being discontinued.

An important factor in the selection of the engine was the future demands on the plant. In the planning stage of 1954 the peak load was 600 kw, disregarding the seasonal peak of the seed drying plant which is for only 60 days and which will probably remain fixed indefinitely.

Based on today's formula for forecasting, the peak will not quite double itself in ten years but the total capacity generated will double itself. By retaining the 300-hp unit and adding the 1700-hp Cooper-Bessemer gas-diesel, Lake Crystal has adequate capacity for ten years. Otherwise it would have been necessary to add another smaller unit within seven years.

To have purchased a smaller engine at this time would not have realized any appreciable saving in fuel and operating costs. This is because of the ability of today's high output, supercharged gas-diesels to operate at exceptional efficiency over a wide range of loads. Maintenance and lubricating oil consumption are correspondingly lower in obtaining more power from the same engine unit.

Perhaps the most significant thing demonstrated by Lake Crystal's records is the fact that a higher output engine can be operated around the clock efficiently, eliminating the concern of sudden heavy loads placed on the plant's system. This is a contrast to many electric generating plants that suffer in operating costs at inefficient loadings because of anticipation of sudden heavy loads from industrial customers.

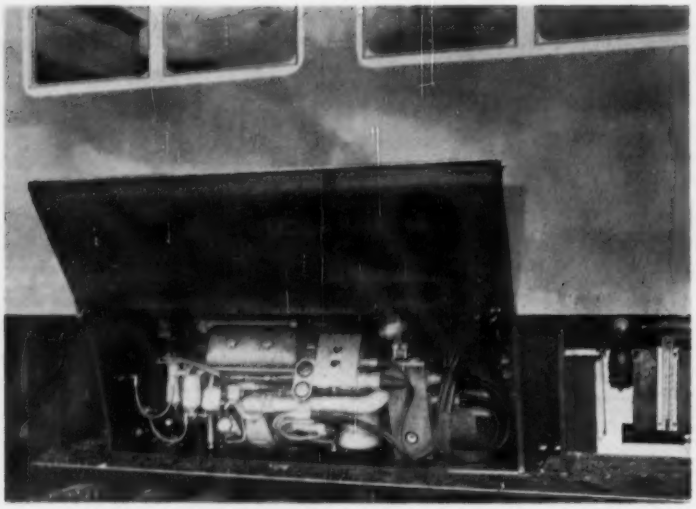
Also, with the modern gas-diesel, the problem of unburnt exhaust carbon in smoke are considerably less than ten years ago. The cleaner exhaust is a tribute to the better combustion of fuels at partial engine loads.

Conclusion

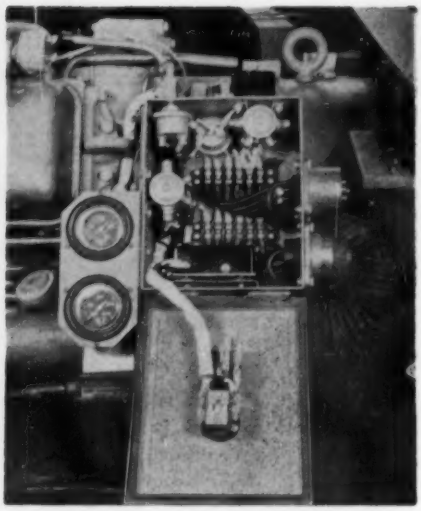
The administration of the Lake Crystal Municipal Power Plant is by three commissioners appointed by the mayor. One is appointed each year to serve a three year term. The commissioners in office at the time of the plant extension were Charles Sumner, Evan Hughs, and Ray Larson, Chairman.

These men as well as the plant personnel should be complimented for their foresight in realizing that obsolescence of machinery is a major factor to be contended with. Power plant supervisors and all others concerned with its efficient operation both today and in the future would do well to follow the example set by the Lake Crystal plant.

Old equipment cannot possibly compete with modern machinery either in efficiency or capacity per unit of space. In many cases you can't afford *not* to replace obsolete equipment in order to operate economically and at the same time provide for future expansion.



Diesel engine alternator unit installed under car. Radiator seen at engine end.



Engine control box with cover open.

Under-Car Units Provide All Auxiliary Power

Comfort of fluorescent lighting and air-conditioning takes a lot of power. Diesel-generator sets supply it efficiently and economically on L.I.R.R. passenger cars.

MODERN diesel engine-driven under-car power units furnish electricity for modern conveniences on 80 new locomotive-drawn passenger cars. They were received only recently by the Long Island Railroad. The additional electrical load of air-conditioning, ice-water, and fluorescent lighting precludes the use of the older axle-driven generator and battery system.

Conditions Dictating This Equipment

Existing cars in similar service which had only a lighting load required constant battery charging from standby power. Sometimes at either one or both ends of the runs. This was because the axle generators on these cars in commuter service could not keep the batteries sufficiently charged. The runs were usually short and the stops frequent. On the new cars in the same service, stepped up electrical power demand virtually ruled out the axle generator and storage battery system as practical. This was essentially due to fluorescent lighting and air-conditioning.

General Description of Power Units

A model 3-71 Detroit Diesel 2-cycle engine is directly connected to a 25-kw Delco Frigidaire ac generator. It supplies 220-v, 60-cycle, 3-phase power. This alternator has a built in dc generator for supplying 32-v power for charging the 16 cell lead battery, miscellaneous lights, and control circuits. Engine starter works off the storage battery. A hydraulic governor maintains essentially constant speed at variable load; a static regulator maintains constant alternator voltage output at variable loads.

Set on resilient mounts to the car underframe, the unit is completely self-contained. Mounted in a specially designed, sound-proof box it has a steel sheet on the outside and a perforated steel lining on the inside. Insulating material is between the two layers.

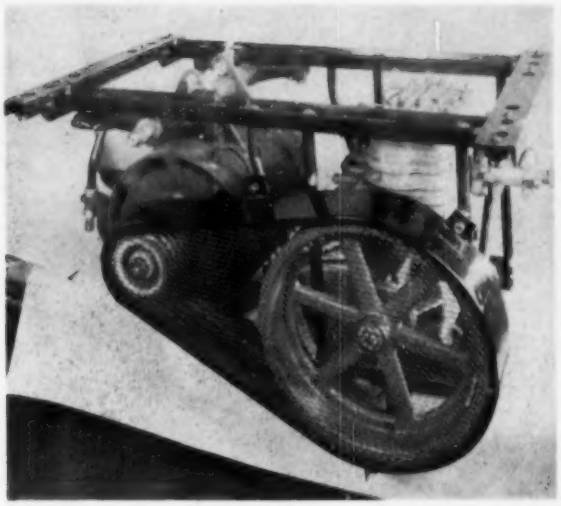
The power unit may be rolled out for necessary maintenance and repair. For removal, slide out extension rails and remove lock-in bolts, clamping blocks, and unlocking roll-out stops. Disconnect electrical, fuel and coolant line connections. All these are designed for quick release and speedy accurate reconnection. The use of a hoist or shop lift truck is required to lift it from the rails after the unit is rolled out.

A 150-gal fuel tank is mounted along side the engine box. The C-O-Two Company manually-operated fire extinguisher system is installed at the engine housing.

Engine exhaust is underneath the car directly under the center sills and directed at a 45-deg angle toward the ground. After leaving the muffler, the exhaust gases are ejected through a funnel shaped spreader to produce a minimum back pressure on the engine.

Some Additional Details

In addition to the generator set and the 8-ton capacity air conditioning unit, Frigidaire furnished other equipment peculiar to such an installation. There is a cooling-water radiator unit, with a blower operated by a ¾-hp, 220-v, 60-cycle, 3-phase motor. A two-unit static ac voltage regulator mounted in the control locker within the



Four-cylinder compressor-motor with frame to be mounted under car.

car consists of the main voltage regulator unit and an auxiliary current transformer assembly.

An elapsed-time and frequency meter records the engine running hours and simultaneously the power frequency. Meter is arranged to show elapsed time reading 0-9999.9 hours in 1/10 hour steps. Frequency meter is scaled to show cycle per second from 58 to 62.

A type T-3 timer relay operates in conjunction with a liner contactor. It delays application of loads to the power plant until the engine attains full speed. Thus, the alternator voltage is stabilized.

The battery charging regulator is a heavy-duty carbon pile regulator. It is especially designed for use with the dc generator and built into the alternator.

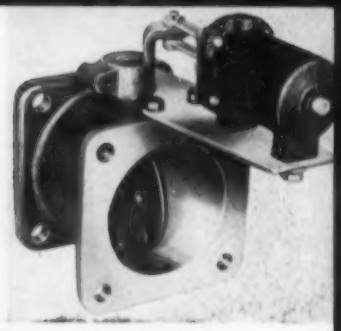
For controlling operation two type PB-2 start-stop push-buttons are connected in parallel. One is located on the engine control box cover and the other in the car electrical locker. A type "SR" starter relay operates in conjunction with the start push-button. It sets up the starting circuit for the engine starting motor.

A transfer panel provides arrangements for transferring loads from power plant to standby service. A built-in line contactor operates in conjunction with the T-3 timer and connects electrical loads to stand-by power supply panel. The engine must be stopped to de-energize the diesel power contactor before the standby power contactor can be energized. This is done by plugging into the standby receptacle, the outside source electrical power. The engine can be operated at no load for service checks after the outside power is maintained.

Hence the decision to install the under-car diesel engine-generator sets. Such power plants make the cars independent of speed, number of stops, and running distance. In terms of maintenance, it eliminates the need for many expensive terminal standby facilities for battery charging.

Diesel Exhaust Brake

by Mack



ADDING to diesel truck safety, an exhaust brake increases engine retardation by more than 50%. Mack Trucks, Inc. also announced that it greatly reduces wear on brakes.

A simple butterfly valve in the exhaust line creates back pressure which transforms the engine to an air compressor. This augments the full engine braking which Mack has long claimed as a feature of their trucks.

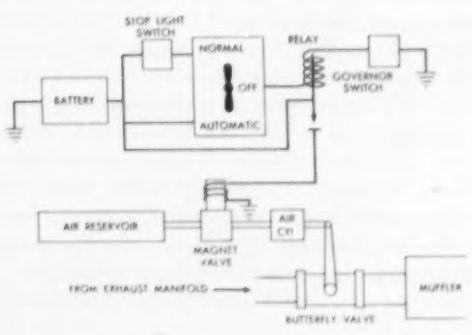
The electro-pneumatic control system utilizes engine compression to assist in slowing down, retarding speed on down-grades, or coming to a halt. It is under driver's control constantly.

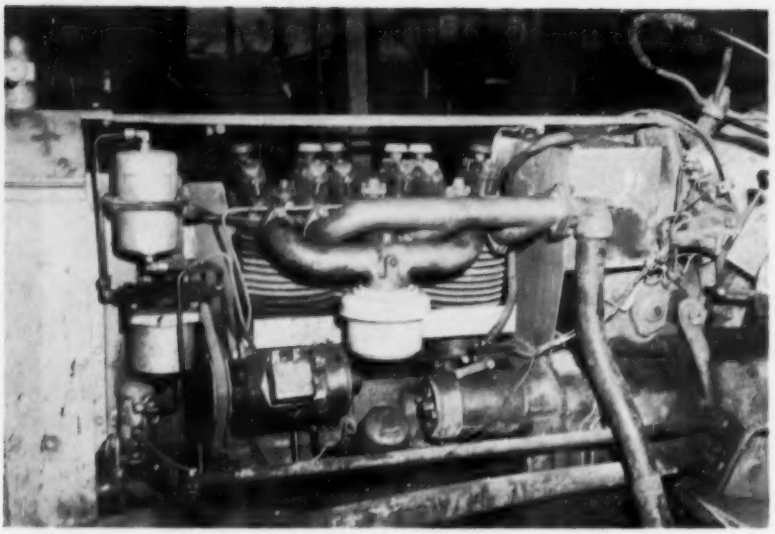
Control is accomplished through a three-position switch. Driver may select setting where exhaust brake will either actuate automatically when brakes are applied, respond to release of accelerator, or cut out of action entirely. When in either of the first two positions, an override switch actuated by fuel injection pump allows compression breaking only when injection ceases. Thus, nothing but pure air is trapped by the butterfly valve and compressed.

Power to operate the butterfly valve comes from an air cylinder connected in with the regular air brake system. Admission and exhaust of air is controlled by a magnet-valve.

Mack point out that the exhaust brake is not new. It was first introduced experimentally in this country in the late 1920's. More recently it has seen more extensive use in Europe. They state that here Mack is the first to offer it as standard optional equipment.

Exhaust brake schematic





Fermont 3-cyl air-cooled diesel engine installed in a Ford 8N Tractor. Operating in competition with gasoline engine tractors for six months, it used less fuel and pulled a greater load.

Fermont Makes Air-Cooled Diesel

Air-cooling plus patented piston and combustion chamber design make engine practicable for varied small engine uses.

AN air-cooled diesel engine will soon be available from International Fermont Machinery Co., inc. Ratings of from 10-hp to 35-hp depend upon choice of one-, two- or three-cylinder versions. A 4-cyl vee-type model will be added at a later date.

Combustion Chamber

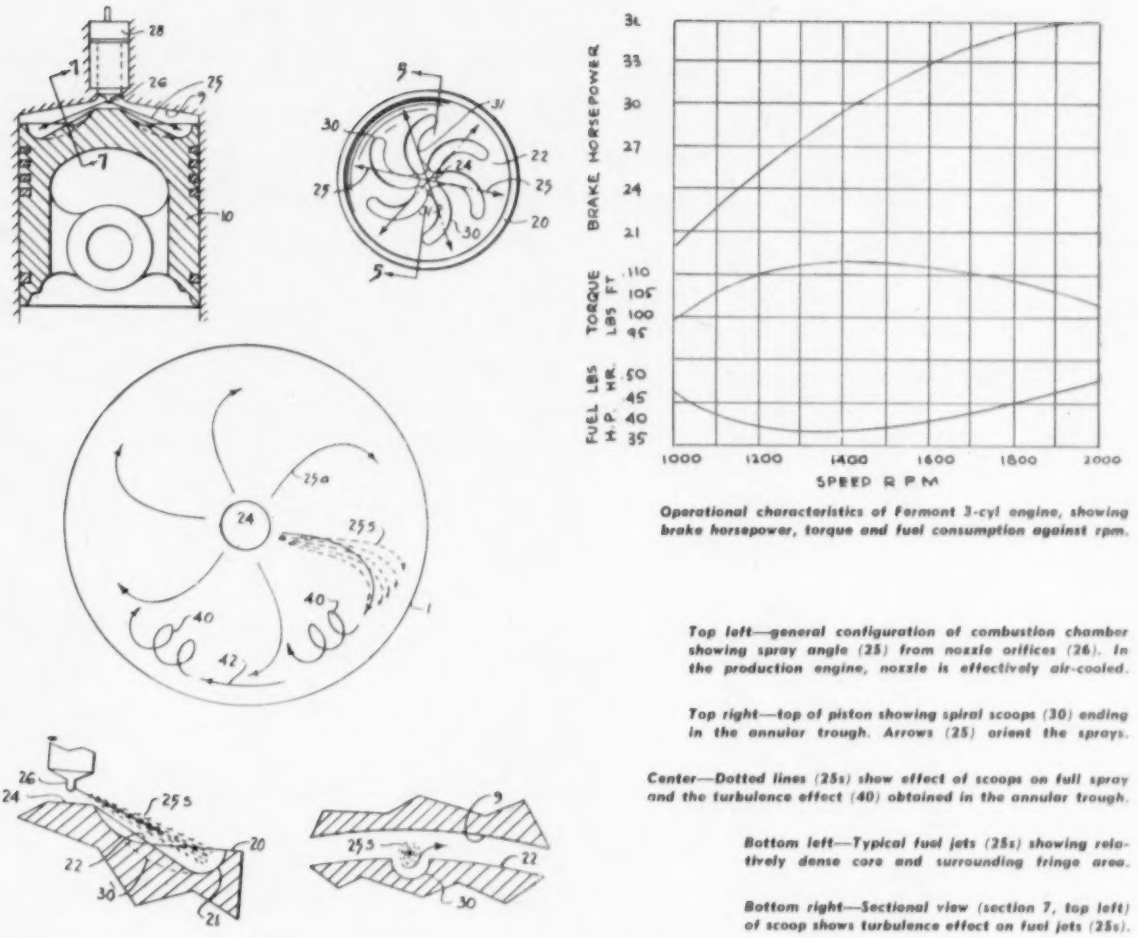
Interest in the new engine focuses around the design of the combustion chamber. Cylinder assembly is designed around a patented low-pressure, "open" combustion chamber, with the injection nozzle centrally located in the cylinder head. This design combines the features of the open-type chamber while providing high-turbulence associated with squish-type, or precombustion systems.

Cylinder head and pistons are conically shaped. The piston crown has spiral scoops and an annular trough. During the inward compression stroke, these configurations create a flow of air upward at the flange, which forms the outer periphery of the annular trough. The spiral scoops, or grooves, impart a spinning of the air mass being compressed. This sets up a compound system of agitated currents.

Into this complexly turbulent air, the fuel jets are injected at an angle bisecting the angle of the cylinder head and piston crown. Each of these jets is directed tangentially over one of the spiral grooves in the piston crown. Thus the same spinning effect occurs to the fuel streams during injection. It continues following injection cutoff until the power stroke is completed.

The fuel jet is comprised of a relatively dense central portion surrounded by a zone of progressively-finer spary particles. These are referred to as the "fringe area". Within this finely divided "fringe area", proportionately greater total surface of fuel contacting air results in rapid ignition of the minute particles. This process in turn creates a rapid rise in temperature in its immediate vicinity. Thus, contralled and complete ignition of the larger particles of fuel is accomplished.

In the power stroke, according to the designer, the whirling and spinning systems of air deflect even the heaviest portion of fuel jets. Ignition is complete with none of the jet streams impinging on the cylinder wall.



Operational characteristics of Fermont 3-cyl engine, showing brake horsepower, torque and fuel consumption against rpm.

Top left—general configuration of combustion chamber showing spray angle (25) from nozzle orifices (26). In the production engine, nozzle is effectively air-cooled.

Top right—top of piston showing spiral scoops (30) ending in the annular trough. Arrows (25) orient the sprays.

Center—Dotted lines (25s) show effect of scoops on full spray and the turbulence effect (40) obtained in the annular trough.

Bottom left—Typical fuel jets (25s) showing relatively dense core and surrounding fringe area.

Bottom right—Sectional view (section 7, top left) of scoop shows turbulence effect on fuel jets (25s).

Maintenance

Considerable space has been given to description of combustion chamber design and combustion process. Otherwise, the engine follows quite conventional design practice for air-cooled diesel engines.

With all engines using the same basic cylinder, procurring parts becomes a relatively simple problem. In addition, engine is constructed for simplicity of assembly and disassembly.

Each cylinder head and power assembly may be removed as a unit. By removing connecting rod cap and four cap screws at base of the cylinder, the head, cylinder, piston and connecting rod may be withdrawn without disturbing component parts. In multi-cylinder applications, none of the others need be disturbed.

Performance

To form a basis for performance data, engine has been observed in over 1000-hr of operation. A 3-cylinder model was installed in a Ford 8N Tractor which operated for six months in and around a large foundry. It functioned in competition with a fleet of twenty similar tractors powered with gasoline engines. In an average 8-hour day the diesel tractor is reported to have used less than half the fuel used by the gasoline tractors. In comparative pull tests the diesel tractor was reported to pull more than the gasoline-engined tractors.

Records of this six-month test show also that there were no repairs to the engine; no service to the fuel injection system; oil was changed every 200 hours and no oil was added between changes. Although operating conditions were bad with heavy dust, soot and foundry grime, cooling fins remained clean and uncluttered during the entire period.

Conclusion

The manufacturer foresees use of his engine in such applications as construction machinery, pumping units, and in conjunction with generators. His 3-cyl engine fits into the same space as a Ford 4-cyl liquid cooled gasoline engine. Many other types of installation are anticipated in uses where a small, air-cooled diesel engine will prove advantageous.

Controlling T/C Output Shaft Speed

A separate mechanical-type governor maintains constant torque converter output shaft speed by controlling engine speed and output to meet torque requirements.

CONSTANT output shaft speed, regardless of engine speed or load fluctuations, is often essential on diesels with torque converters. How this is obtained on one specific make of diesel and the governor operation and adjustments on this particular engine will now be discussed. This information and data also applies to any manufacturer's engines using similar type governors.

As an example, let us use a Pierce mechanical-type governor. G. M. Series 71 engines with torque converters use this governor to get a constant output shaft speed.

Description

This governor (Fig. 1) is located at the rear of the engine. It may be driven by the output shaft of the torque converter, or belt-driven by a pulley on the torque converter output shaft. If the governor is belt-driven, an internal oil sump is provided for lubrication. But if it is gear-driven by the torque converter output shaft, lubrication is through an external line from the torque converter to the governor.

The governor includes two weights, a weight carrier and shaft, a weight riser and bearing assembly, and an operating fork. The operating fork is connected to the governor control shaft which projects from the governor housing. Pinned to the control shaft (9), are a linkage operating lever (8), and spring retaining arm (10). One end of the spring retaining arm is drilled for attachment of a governor spring (11). The other end of the governor spring is attached to an adjusting eye bolt (12), which is held securely on the speed control shaft adjusting lever (13).

The upper end of the speed control shaft adjusting lever contains two screws (14 and 15), for limiting the maximum and minimum output shaft speed. The speed control shaft adjusting lever is pinned to the speed control shaft (16), which passes through the speed control shaft bracket (20), bolted to the governor housing.

On one end of the governor speed control shaft is pinned a speed control shaft lever (17), which may be remotely controlled. Mounted on the other end of the control shaft, on some governors, is an overrule lever (18) which is free to rotate on the speed control shaft.

Attached to the overrule lever is a ball bearing roller (19), which may be adjusted to contact the projecting arm of the linkage operating lever.

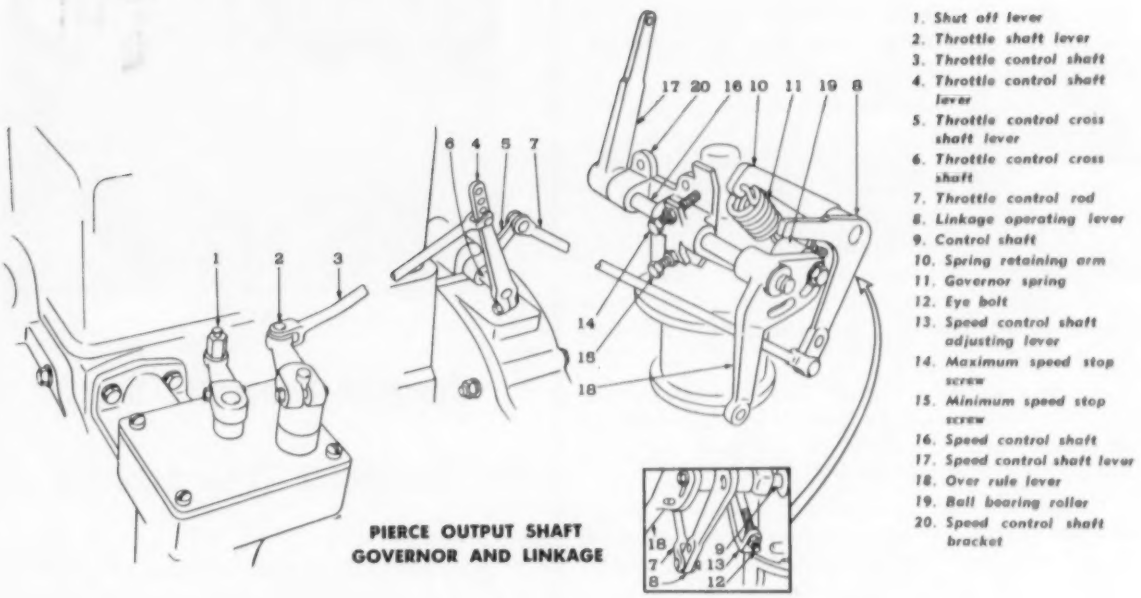
Operation

With the engine at idle speed and the output shaft of the torque converter stalled, the speed control shaft lever is set to get the desired output shaft speed. As the speed control shaft lever moves, tension is placed on the governor spring by the travel of the speed control shaft adjusting lever.

As tension is applied to the governor spring, the force exerted by the spring pulls down the spring retaining arm which is pinned to the control shaft. This moves the linkage operating lever towards the rear of the unit. Movement of the linkage operating lever pulls the engine governor through the connecting linkage towards the *full-fuel* position.

As the torque converter output shaft begins to rotate, the weight carrier shaft of the governor, which is either gear-or belt-driven, also begins to turn. As the torque converter output shaft nears the desired maximum rpm setting, the centrifugal force of the weights cause the riser to move along the weight carrier shaft counteracting the tension of the governor spring (11). The converter output shaft will now be operating at its maximum governed speed.

On some applications where a very low speed is required, such as in structural steel setting, the governor may be equipped with an overrule lever. This allows the operator to decrease output shaft speed to zero or slightly above, depending on the output shaft load. The over-


1. Shut off lever
2. Throttle shaft lever
3. Throttle control shaft
4. Throttle control shaft lever
5. Throttle control cross shaft lever
6. Throttle control cross shaft
7. Throttle control rod
8. Linkage operating lever
9. Control shaft
10. Spring retaining arm
11. Governor spring
12. Eye bolt
13. Speed control shaft adjusting lever
14. Maximum speed stop screw
15. Minimum speed stop screw
16. Speed control shaft
17. Speed control shaft lever
18. Over rule lever
19. Ball bearing roller
20. Speed control shaft bracket

PIERCE OUTPUT SHAFT GOVERNOR AND LINKAGE

rule lever is necessary because the output shaft governor will not function at very low output shaft speeds.

Moving the overrule lever makes the ball bearing roller contact the linkage operating lever moving it towards the *idle* position. This reduces the torque converter output shaft speed as desired. To shut down the engine the overrule lever should be positioned to move the engine governor throttle control lever to *idle* position. The engine may then be shut down by moving the engine governor shut-off lever to the *stop* position.

If there is no overrule lever on the output shaft governor, the engine may be shut down by forcing the speed control shaft lever towards the reduced speed position by means of remote control linkage to this lever. As the speed control shaft lever moves towards the reduced speed position, the extension of the speed control shaft adjusting lever contacts the lug on the side of the spring retaining arm forcing the arm to move to its uppermost position.

This upward movement of the spring retaining arm rotates the control shaft and forces the linkage operating lever to reduce fuel input. This puts the engine governor in the *idle* position and the unit may be shut down by moving the shut-off lever on the engine governor cover to the *stop* position.

Adjustments

The function of the torque converter output shaft governor is to control the engine limiting speed governor through the connecting linkage. Refer to the schematic drawing and adjust the governor and linkage as follows:

1. Adjust exhaust valve clearance (hot) to 0.009-in. Manual, form 6SE101.

2. Time fuel injectors using proper timing tool. For injector 60 or HV6 use Tool No. J-1242; for 70 or HV7 use J-1853; for 80 or HV8 use J-1853.

3. Adjust the engine limiting speed governor (refer to G. M. Operator's Manual, Form 6SE101). The linkage from the output shaft governor must be disconnected when adjusting the engine governor, then reconnected after the engine governor adjustments are made.

The engine governor cover throttle shaft lever moves approximately 32½ deg from *idle* to *full-fuel* position. The throttle shaft lever should be adjusted so that when it is in the center of its travel, it is on an imaginary line through the center of the governor operating shaft perpendicular to the cylinder head. This allows the throttle shaft lever on the engine governor and the speed control lever of the output shaft governor to move approximately the same distance.

This adjustment can be made by loosening the bolt on the throttle shaft lever, and the bolt on the throttle controls shaft (short) lever (5) and moving the governor cover throttle shaft lever to the desired position then retightening the bolt.

The throttle control shaft (3) should be attached to the bottom hole in the throttle control cross shaft (4 hole) lever (4).

4. Lubricate all joints of the throttle control linkage and make sure that the linkage is free of any binds.

5. Loosen lock nut and turn in the output shaft governor minimum speed stop screw (15), until sufficient spring force is applied to hold the linkage operating lever (8) in the *full-fuel* position.

6. Hold the throttle control cross shaft (4 hole) lever (4), in the *full-fuel* position and tighten the clamping

bolt in the throttle control cross shaft (short) lever (5). This will put both the linkage operating lever (8) and the governor cover throttle shaft lever (2) in the *full-fuel* position.

7. Back out the minimum speed stop screw (15) until it is flush with the rear face of the minimum speed screw retaining boss of the speed control shaft adjusting lever (13). Place the linkage operating lever (8) in the *full-fuel* position. Move the speed control shaft lever (17) towards the minimum speed position until the extension on the speed control shaft adjusting lever (13) contacts the lug on the spring retaining arm (10) forcing the throttle shaft lever on the engine governor into the *idle* position.

If there is no lug on the side of the spring retaining arm (10), the minimum speed stop screw may be backed off until the eye bolt (12) to the bottom of the spring retaining arm (9) clearance is 1/8-in.

The above adjustments permit the engine to be returned to *idle* position through the movement of the speed control shaft lever (17) towards the reduced fuel position. On some applications the low speed stop screw (15) may be used to maintain an engine speed above the idle setting. On these installations it is necessary to use the overrule lever (18) to return the engine to the idle speed before being shut down.

8. Hold the speed control shaft lever (17) in the minimum speed position, established in step 7 above, and screw the minimum speed stop screw in until it contacts the speed control shaft bracket (20). Retighten lock nut.

9. Holding the speed control shaft lever in the minimum speed position, back off the inner nut on the eye bolt (12). Turn in the outer nut (clockwise) on the eye bolt (12) until the spring is just barely tight. Retighten the inner lock nut.

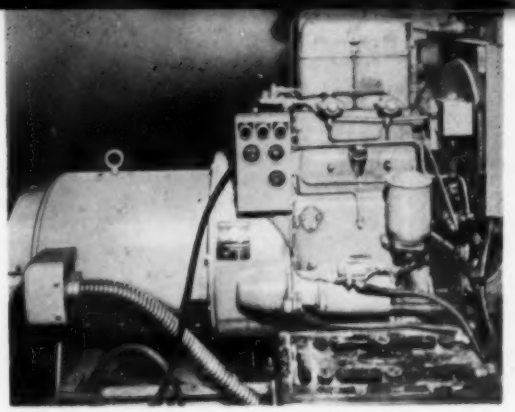
Do not preload spring to the extent that it would prevent the throttle shaft lever on the engine governor from moving into the *idle* position.

10. Start engine, and move the speed control shaft lever (17) in a direction to provide the maximum desired no-load output shaft speed. The no-load speed of the output shaft should be approximately 200 rpm higher than the required full-load speed.

Any remote throttle control linkage attached to the speed control shaft lever (17), must be very rigid and hold the speed control shaft firmly without permitting it to move in response to engine speed changes.

11. Turn in the maximum speed stop screw (14), until the screw contacts the speed control shaft bracket (20) and tighten lock nut to maintain the no-load speed setting.

12. Move the speed control shaft lever (17) to the *idle* position, and then return to the *full-fuel* position thereby bottoming the maximum speed stop screw (14) against the speed control shaft bracket (20). There should be no change in the high speed setting of the engine.



Compact Generator Set for Commuter Train Lighting

PASSENGERS on some of the suburban commuter trains in the Chicago area now can comfortably read their morning papers before the locomotive is coupled to the train. A Nordberg "Power Chief" generator set operates independent of the generator in the locomotive, and provides the power to light a fourteen-car train.

Completely self-contained, the generator set is located in a compartment at one end of the car. Shock absorbing mounts protect the engine from shock and the passengers from vibration. A sound-proof compartment makes engine inaudible when train is in motion. A small instrument panel contains oil pressure gauge, ammeter and starter button. Should electric starting fail engine can be hand cranked with the aid of a compression release.

When one thinks of Nordberg he usually thinks of large engines; but Nordberg also makes some rugged little 4-cycle units. The 4FS-2 diesel engine powering the set is designed for durability and easy maintenance.

Many big engine features are found in the smaller edition. As in the larger units wet-type liners are used, as well as individual cylinder heads. Adequate hand holes in the base give easy access to the bearings and oil pump.

The engine is equipped with a pressure lubrication system. Both crankpins and main bearings are precision steel shells lined with anti-friction metal.

Use of Nordberg "Power Chief" generator sets on rails is by no means new and untried. A 6-KW unit is intalled in Santa Fe's "Kansas Territorial Centennial Exhibit", and many Pacific Fruit Express cars use 15-KW sets to protect frozen food in transit. Several of these Nordberg diesel-generator sets are being placed in service by The Milwaukee Road to provide adequate and uniform lighting for their suburban passengers.

Straight from the Tool Box

This is YOUR Department. Pass along your ideas to the other fellow. Send items to the Editor, preferably with a picture or sketch. Contributors will receive $10.00 for each item upon publication.

Locating Cracked Cylinder Head

J. D. POWELL, Chicago, Ill.—Several times in the past, the engines I worked on have had a slight crack in one of the individual cylinder heads. If the crack is very small, it is difficult to find which of the heads is causing the trouble. As soon as you shut the engine down, the metal contracts and the crack closes. I use a method of looking while the engine is running and is at operating temperature. It is at this time that the crack is open.

First take a pressure gauge. Attach it to the water outlet as close as you can to the header. Start the engine. If the engine is running properly with no cracks in the heads the movement of the needle on the gauge would be very slight. But if one cylinder is cracked, every time that cylinder fires some of the burning gasses will be forced into the water. This will cause the needle to take a sudden jump.

All you have to do now is to cut out the cylinders one at a time. When you have cut out the right one, that is, the one with the cracked head, the needle of the gauge will not jump, but will remain steady. Now that you know which head is to blame, you can replace or repair the head that is causing the trouble.

On vee-type engines you may have to put a pressure gauge on both sides, because you may have two separate water jackets. Also, it is possible to use this same method of finding a cracked cylinder head by putting the gauge on the water pump. I have always found it better though, to put the gauge on the header.

This is certainly a good way of locating a hard-to-find crack on an individual cylinder head. Fact is, you are not the only one to use it. Several large engine manufacturers and service shops use it too. It's a time saver and will bear repeating.—Editor.

Portable Air for Cleaning

JOHN RIPP, Jersey City, N. J.—Most of the maintenance work I've done has been field repair, away from the more elaborate facilities available in the shop. This has made it necessary to improvise on certain items that you just can not carry around with you.

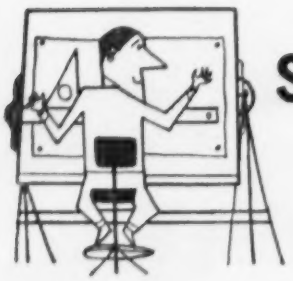
As any maintenance man knows, the hardest part of field work is trying to work "clean". This is especially true of working in sumps and recesses where dirt has a tendency to build up. You have to be careful when removing any part from the engine that exposes a hole into some engine system. Without cleaning, the dirt crust will be broken loose when the part is being loosened. It will fall to the bottom, and drop in when the part is lifted out. To avoid this problem, all the dirt, including the smaller pieces, should be blown away.

You have a portable air-compressor around. It's such a simple thing that you probably overlooked it. A hand tire-pump will supply enough pressure to remove loose grit and dirt. Heavy material can be first loosened with a scraper and brushed or wiped away. The finer dirt can then be blown out.

Another way is to fill an inner-tube with air before leaving the shop. By directing the valve you can blow away any loose material, and the air supply is usually adequate for one entire operation.

I have used both these methods many times. It makes cleaning a lot easier and helps to keep dirt out of the engine.

You are right—the simplest solutions are frequently overlooked. It is certainly necessary to clean an area before you start to work on it and to keep it clean as you go along. Your idea should be most helpful to road or field service men who frequently undertake repairs in out-of-the-way places.—Editor.



service section

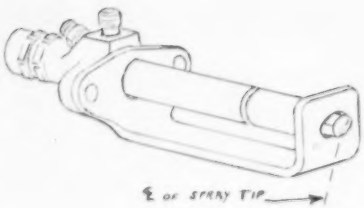
Recent engine and equipment modifications, procedures and recommendations straight from the different manufacturers to you

P & H Injector Tip Setting Jig

It has come to our attention that it is possible to set the spray angle 180° off location on the Demco injector when using part number 40825 tip setting tool. The tool is marked for the proper location of the orifice, however, it is possible to invert the injector assembly when placing it in the tool, resulting in the orifice being on the opposite side.

The injector should be placed into the tool with the inlet fuel connection facing upward and the orifice in the location marked on the tool.

The accompanying sketch shows the proper method of setting the injector tip for correct spray angle.



Tightening Cylinder Head Studs On Alco Engines

The proper procedure for tightening cylinder head studs is carefully outlined in the various instruction and maintenance manuals. Many instances have occurred, however, where improper tightening has caused extensive damage.

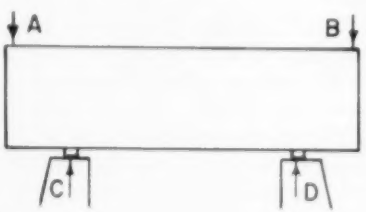
To help eliminate these instances, we include the following explanation of how damage results from improper tightening.

Consider a section taken through the cylinder head so as to include two of the large stud locations. In the accompanying sketch the large studs bear down on the cylinder head at points A and B. The head rests on top of the liner at the seal ring, indicated at points C and D. The section may be likened to a beam with upward forces at some distance from each end.

A nut is first applied to stud "A" and turned down sufficiently to rock the head about point "C", lifting it off the seal at point "D". When a nut is then applied to stud "B" with only a moderate torque, a very heavy force will be developed at the seal ring, point "C", due to the great lever ratio. The cylinder head is the lever, with the fulcrum at stud "A", the force developed at "C", and the operating force at "B". The lever ratio is about 9 to 1, that is, a force of 40,000 pounds applied at "B" will produce about 360,000 pounds at "C", if yielding does not take place.

This condition can occur whenever the first nut to be applied is turned on enough to lift the head slightly off the seat on the opposite side. If an impact wrench is used, it is easily possible to screw the first nut on too far, without the mechanic realizing that this has occurred. For this reason an impact wrench should not be used.

The powerful forces which can occur as the result of the improper procedures outlined above may cause severe overstresses and cracks which are difficult or impossible to detect.



This difficulty will not occur if the Alco instructions are followed exactly, since all nuts will be sufficiently tight to prevent tipping of the head before a powerful torque is applied to any nut.

news of our industry

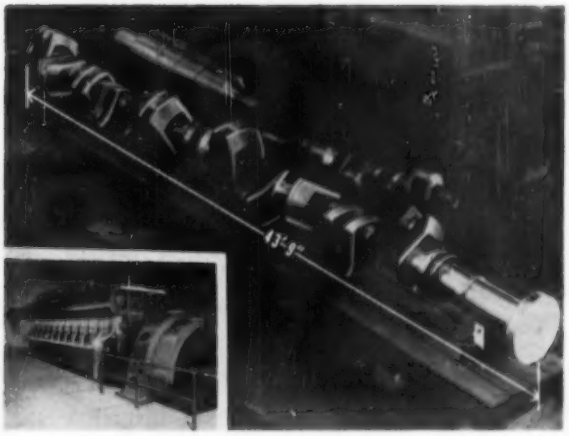
Rubber-Tired Freight Train

Designed to tiptoe across deep snow with close to 100,000 lb of military supplies on its back, this cross-country freight train was delivered to the Army Transportation Corps for use above the Arctic Circle. A production of R. G. LeTourneau, Inc., the carrier travels on 16 tires, each 4-ft wide by 10-ft tall.

The Sno-Train, as it is called, is made up of individually-propelled trailers. This has been achieved by placing an electric motor in the center of each wheel. Should one of the wheels lose traction, its share of the train's total hp is transferred to the other wheels.

One power-generating car and three powered cargo cars comprise the train, the lead car containing a diesel-electric generating set which supplies controllable DC power to the 16 electric wheels and AC power for steering and auxiliary functions. Prime mover is a Model V-12 Cummins. Only two front wheels are steered by the operator, the succeeding cars steered by mechanical coupling devices so that they track automatically. The train will carry a payload of from 30 to 45 tons.

Special features which make the train suitable for arctic travel are aluminum construction for lightness; preheating facilities for its 600-hp diesel engine; a fuel tank capacity of 500 gal (plus pump for fuel transfer from drums); and inclusion of flood lights, winch, and jib crane to aid cargo handling operations. Because arctic expanses have few visible landmarks, a transparent bubble has been built into the roof of the control car to facilitate navigation by position of the stars. It can be used for observation purposes as well and as a kick-out escape hatch in emergency.



46,000-Lb Crankshaft

Claimed to be the largest individual crankshaft ever made is this 43-ft, 9-in long by 15½-in diam forging. It was produced from a 72-in diam medium carbon steel ingot weighing 210,000 lb. Rough forging got it down to 108,460 lb, for a slab size 34⅝ in by 23 in and approximately 45-ft long. Bearing surfaces for the perfected shaft were then polished to mirror-finish. Every operation, from raw material to shipping dock, was completed within the plants of Erie Forge & Steel Corp.

A similar Erie 12 throw crankshaft was placed in a Nordberg diesel engine (shown in inset) recently installed at the Ponca City, Okla. municipal works.

new products . . . . . Page 82

organizational news . . . Page 86

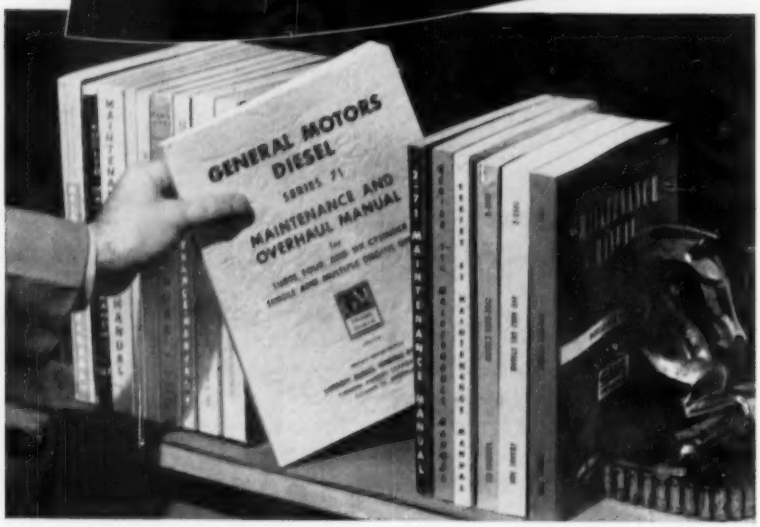
new literature . . . . . Page 88

Correction Notice

Last month's engine specifications carried an erroneous listing for one of White Motor Company's Superior Engines. The continuous horsepower range for Model 8OX-8 should have read 1200 to 1900, at 300 to 375 continuous rpm.

ATTENTION:

- GMC Truck Fleet Operators
- Transit Authorities
- Diesel Engine Overhaul Shops
- Construction Maintenance Departments
- Agricultural Implement Owners
- And All End-Product Users of Detroit Diesel Engines



How special tools save you time and money

When there's a service job to do and you reach for the manufacturers' maintenance manual, you've got a wonderful chance to cut your time and cost of doing that job. That chance comes when you see that the manufacturer has recommended a special service tool to do the job right. When it specifies the use of a "J- or KMO-number" tool, you know that the prefix designates Kent-Moore Rate-Maker Special Service Tools. Your next step is to . . .

REACH FOR THE KENT-MOORE TOOL MANUAL

There are separate manuals for GMC Trucks and GM Diesel Engines. Model applications are clearly noted. Diesel Tool Guide covers all three series of engines; series 51, 71 and 110. Supplements will be issued periodically as new tools or better methods are devised.

KENT-MOORE SPECIAL TOOLS MEAN FASTER, BETTER SERVICE JOBS . . .

without danger of damaging parts . . . and at a lower labor cost than is possible with improvised, makeshift methods. All Kent-Moore Tools are designed in cooperation with the original manufacturer. Every time you open up a package of tools from Kent-Moore, you are sure of the kind of results that can come only from an organization that is exclusively engineers and manufacturers of special service tools and equipment.

KENT-MOORE ORGANIZATION, INC.

Dept. C, 1501 So. Jackson St., Jackson, Michigan

ENGINEERS AND MANUFACTURERS OF SPECIAL SERVICE TOOLS AND EQUIPMENT

WRITE TODAY! If you do not already have your copies of these manuals.

news of our industry

Low Temperature Research

University of Wisconsin engineers are currently trying to find a way to generate heat quickly and efficiently in temperatures as low as 80 degrees below zero. The project is being conducted under the sponsorship of the Engineer and Research Development Labs at Ft. Belvoir, Va.

Efficient heaters are needed for the cab space of machines to provide some warmth for the operators, to de-ice windshields, to warm up anti-freeze liquid, to heat engine blocks and lubricating oil, and to heat the battery compartment so that the batteries will be able to put out sufficient energy to start engines.

Prof. J. R. Akerman, supervisor of the project, says that the heaters should be able to work in extremely low temperatures with any kind of fuel that can be found at any armed services base. They should also be light, corrosion-resistant, and be able to start within 120 sec with little or no power starting requirement, to operate continuously for 150 hr with no maintenance, and to operate in a 40-mi wind.

The overall problem is really a 4-way research and development job: first determining if such a heater can be built, next determining how it can be put together, then detailing the design for production, and finally refining the design for most efficient production in quantity.

To carry out the project, the university has extended its heating and ventilating laboratory with a super deep-freeze. The low temperature test room has produced 92 below zero in its initial trial, which is 2 degrees below the coldest temperature ever officially recorded on earth.

Hyster Factory Expansion

A $150,000 addition to its Peoria, Ill. factory is scheduled to start in June for Hyster Co. Expected to add approximately 25,000 sq ft to present facilities, the extension will be used to increase production of matched performance equipment for Caterpillar-built tractors.

news of our industry

British-Built I-H Tractor

International Harvester Co. has come out with a small farm tractor intended for overseas consumption. It will be entirely British-made and a new factory in Yorkshire is being exclusively devoted to its manufacture.

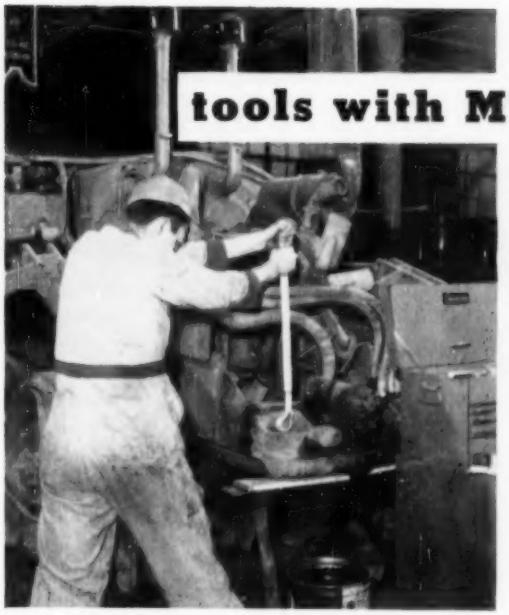
Called the Model B-250, it employs a 30-bhp water-cooled diesel, a 4-cyl unit with a 144-cu in displacement. Compression ratio is 19:1. Starting is accomplished by a 12-v electric system with an assist of glow plugs for pre-combustion chamber heating. The tractor has five forward speeds, one reverse, and a straight move into reverse may be accomplished from first.

LMOA Preconvention Schedule

The grass-roots approach is again being tried this year by the Locomotive Maintenance Officers' Assn. in anticipation of its 1956 convention. It is conducting preconvention presentations of technical reports prepared for the annual meeting.

As in the past, this arrangement makes it possible for those who will be unable to attend the convention to personally participate in part of the work, benefit from floor discussions, and contribute their ideas to the final reports.

Interested readers are invited to the following: May 15—Louisville Railroad Diesel Club, 7:30 pm, "Progress Report on Extending Service Life of Pistons, Rings, Liners, and Cylinder Heads"; May 17—Great Lakes Railway Diesel Club, Cleveland, 7:30 pm, "Progress Report on Extending Service Life of Relays and Contacters"; May 21 — Mid-South Airbrake & Diesel Club, Memphis, 2 pm, "Value of Visual Aid in Personnel Training"; May 22 — Northwest Locomotive Assn., St. Paul, 8 pm, "Diesel Water Treatment"; May 24—South & Southwest Railway Club, Jacksonville, 9 am, "Tools, Jigs, and Testing Equipment"; May 28—Rocky Mountain Diesel Club, Denver, 6:30 pm, "Diesel Water Treatment"; June 12—Southeastern Railway Diesel Club, Jacksonville, 9 am, "Air Compressor and Gear Case Maintenance."



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to service big equipment

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Heavy-Duty BOXOCKET® WRENCHES

Here are the husky, powerful wrenches servicemen need on every construction machinery repair job. They're safe, dependable . . . the kind mechanics can really "lay into." And they're available in straight or offset models in a wide range of sizes.

The tightest nuts and bolts turn easily under powerful Boxocket leverage. Their trim build and long reach get these tools into location quickly and easily. When free swing is restricted, double hexagon broaching allows a short turning arc. Extension handles lock securely, can't be separated accidentally — a safety factor you and your mechanics will appreciate.

Yes sir, it's tools like *Snap-on* Boxocket wrenches that help cut downtime — put money-making machinery back to work fast. See your *Snap-on* tool dealer or write for new catalog "V" of over 4,000 *Snap-on* tools for servicing construction machinery, trucks and cars.

*Snap-on is the trademark of Snap-on Tools Corporation.

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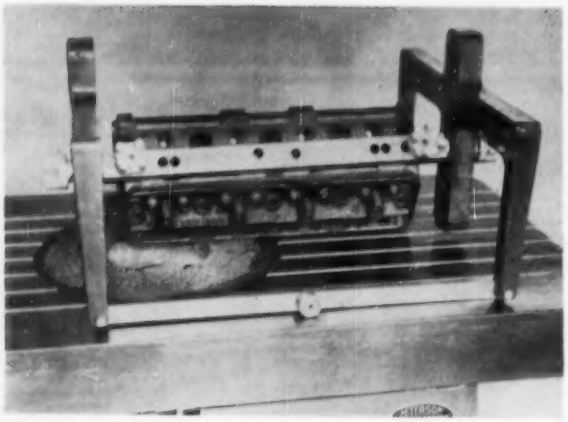
8064-E 28th Avenue • Kenosha, Wisconsin

new products



Universal Valve-in-Head Jig

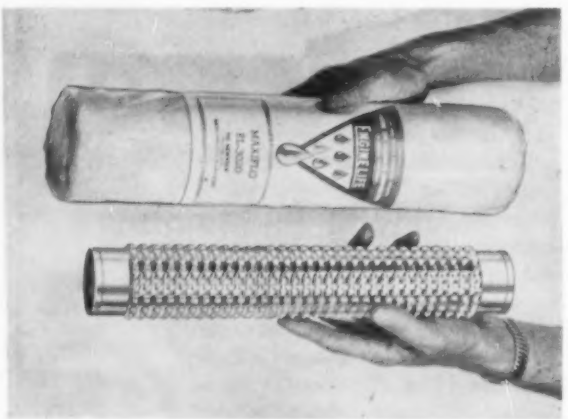
Designed for the grinding of both block face and manifold face of overhead valve V-8 heads, this new jig is claimed to insure manifold alignment of even the latest valve-in-head V-8's. These are said to require that the intake manifold face of the head be ground each time 0.010 in or more is removed from the block gasket face. Unless both faces are ground, it is reported, the manifold will not fit properly and misalignment of intake ports will result, causing burbles and turbulence.

A product of Peterson Welding Laboratories, Inc., the fixture carries the workpiece over the grinding wheel on a tripod of three sealed rollers. It is said to work with all types of dry grinders to produce a perfect flat finish.

Full-Flow Filter

A filter with an unrestricted core has been developed by Engine Life Products Corp. It is designed to handle velocity flows and pressures without differential restriction in the engine lubricating system. The new Maxiflo filter core also has the added feature of giving structural strength to the unit. This is said to have been achieved by not completely punching out each hole in the core, but by bending the metal around each perforation. The retained metal serves as prongs to hold the filter media in place and to prevent sagging or packing as a result of pressure.

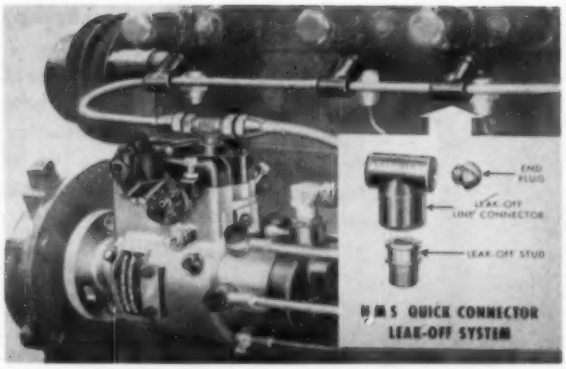
This new type of core, it is stated, allows use of different filtering media so that all sorts of fuels as well as the most viscous lube oil can be filtered.



Fast-Loading Scraper

Named for its ability to get packed, high-volume loads of low void content, this Model C Fullpak scraper is described as "the easiest and fastest loading in the earth-moving industry" by LeTourneau-Westinghouse Co., its manufacturer. It is claimed to be virtually tip-proof, even on steep slopes.

Precision operation is achieved by powerful electric motors triggered by finger-tip switches. Bowl capacity is 18 cu yd, struck capacity 12.2. Scraper load speed and pusher load speed have been matched. When the engine works at its full 2000 rpm, first gear with sliding transmission provides 2.9 mph. Low range at the same rpm with torque converter gives 2.2 mph. Primer mover choices are the 208-hp GM 6-71 2-cycle or the 200-hp Cummins HBIS-600 4-cycle.



Fuel Injector Connectors

Two simple and inexpensive fittings at each nozzle, plus one end plug, are said to produce a leak-off system that is fast and easy to install or disconnect, and still is able to withstand return oil pressure. This new system, developed by Hartford Machine Screw Co., makers of the Roosa-Master fuel injection pump, eliminates flaring, ferrules, and brazing. The only tool required is a hack-saw or tube cutter.

Since the line connectors also act as miniature shock absorbers, the system is claimed to eliminate leaks due to vibration, as well. The three illustrated parts do the job. They consist of a leak-off connector and end plug made of a composition impervious to fuel, and a leak-off stud machined from aluminum.

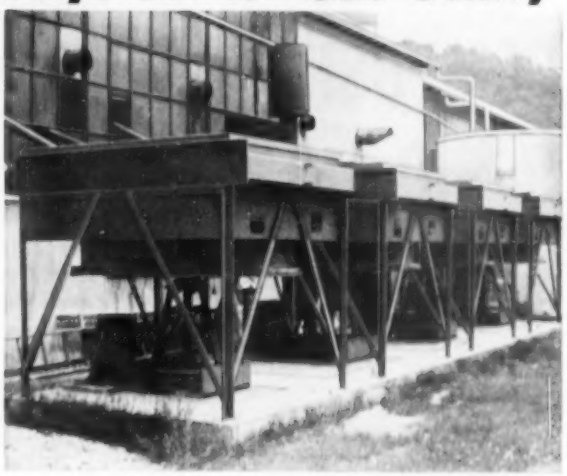
The parts are available to engine manufacturers for use on new equipment and will be offered to engine owners in packaged sets. In addition to their low initial cost, they are claimed to effect savings—on labor for installation, and time for engine shutdowns to change nozzles or repair broken or leaky lines. Fast on-the-spot repair or replacement can be accomplished by the operator at a single nozzle or on the complete system.

Tank Coating

Intended for use as a tank liner in storage tanks or truck, tractor, automobile and aircraft tanks, is Tankite, a product said to have been laboratory tested 18 months and in service in small aircraft tanks for the same period. In that time, it is claimed, it has been unaffected by petroleum products, from lubricating oils up to and including 100 octane aircraft gasoline. Seventy-five hours in lubricating oil maintained at 200°F are said to have left the film unaffected.

One of the features of the product is that films are applied from an emulsion to eliminate toxic solvents and fire hazard during application. As a spray, it may be reduced with a quart of water per gallon. Two sprays or brush coats one day apart are recommended as minimum for ferrous metal tanks, and four coats are the minimum for poured concrete. More porous surfaces must be treated with a filler before application.

Young Engineering Talent
Pays off for Gas Utility*



*South Penn Natural Gas Co. Station, Smithfield, West Va.

Young "HC" Atmospheric Radiators
eliminate cooling water supply problems

The Problem: To replace an old cooling tower serving gas compressors. A nearby creek furnished the uncertain water supply.

Young HC Horizontal Core Cooler and Condenser

How Young solved it

Four Young Radiator Company HC Atmospheric Radiators were specified to cool four 165-hp compressor engines. Natural gas is compressed from local field lines and well-head to pressures suitable for shipping to distant sales points. Installation of the Young Units has modernized the compressor cooling system. In addition it has made the utility independent of the uncertain water supply.

A. Independent mounted fans eliminate unit vibration.
B. Coils designed for easy access to tube ends.
C. Coils supplied for any operating pressure.
D. Steel tanks treated for corrosion resistance.

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Put Young Talent to work for you . . .

Solving heat transfer problems is what we do best because it is our very reason for being. You, too, can harness the power of Young engineering talent. Write, wire or call without obligation.

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Creative HEAT TRANSFER ENGINEERS FOR INDUSTRY
Heat Transfer Products for Automotive, Aviation and Industrial Applications. Heating, Cooling, Air Conditioning Products for Home and Industry.
Executive Office: Racine, Wisconsin, Plants at Racine, Wisconsin, Mattoon, Illinois

new safety solvent

OAKITE COMPOSITION NO. 116

for cold solution cleaning

You'll like new safety solvent, Oakite Composition No. 116. Not only because it has first class cleaning abilities in cold solution form, but also because, when used as recommended, it's safe—both to personnel and equipment.

OAKITE COMPOSITION No. 116 is applied by brush, spray or immersion. Dissolves grease, oil, sludge almost instantly.

OAKITE COMPOSITION No. 116 assures maximum safety. It has a flash point of 234° F. Cleveland open cup. Evaporation loss is minor.

OAKITE COMPOSITION No. 116 is ideally suited where water cannot be used. Cleaning is completed by blowing dry with pressure air.

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SPECIALIZED INDUSTRIAL CLEANING
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MATERIALS · METHODS · SERVICE
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Technical Service Representatives in Principal Cities of U. S. and Canada

new products

Metal Hardness Tester

Newage International, Inc. is marketing a portable hardness tester with direct reading scale. It is said to obtain accurate readings quickly without cutting a sample from or damaging the work. The tester is placed on the metal, handgrips pressed down, and the dial is read.

The unit also eliminates need for conversion charts or calculations. It is calibrated to 1.5 pts Rockwell and 5 pts Brinell. It may be used on thick or thin sections, flats or rounds, and is furnished complete with diamond penetrator and one test block in a wooden case. For continuous-run testing, a bench adapter is available.

Torque-Control Impact Tool

Application of the torsion-bar principle to torque control is the feature of an air-operated Torque Control Impactool developed by Ingersoll-Rand. It is said to run a nut to any desired torque and then automatically shut off. The tool operates at normal power and speed while the nut is being run; but when required torque is reached and resistance equals the stress present in the torsion bar, the impact mechanism rebounds and a shutoff valve is tripped.

Torque setting is done by a jig which turns a torsion bar and calibration collar to the desired reading against an adjusting sleeve. This setting is said to remain constant for each nut-running operation until the adjustment is changed.

The tool comes in two sizes. Size 5040T has two torsion bars available, one with a maximum torque of 60 ft-lb and the other of 90 ft-lb. Size 5340T is factory preset at 320 ft-lb and is adjustable to a maximum 550 ft-lb.

Dry Charged Battery Packaging

Safety in handling and storing of dry charged batteries has been introduced by Globe-Union, Inc. in a new packaging arrangement. Both battery and electrolyte will be contained in one compact unit to allow indefinite storage for both shipper and dealer convenience.

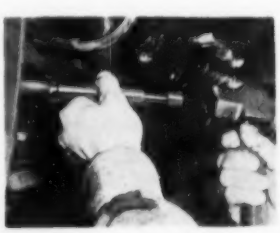
The battery has sealed air vents and special vent cap gaskets to guard against plate contamination. Polyethylene bottles packed with the batteries contain the correct amount of electrolyte. A cardboard sleeve is included for safe handling of the acid containers. Activation of the battery takes place only after the electrolyte is added, which is dependent upon the user. The new packaging method includes both 6- and 12-v batteries.

Fitting Unfreezer

Ram-O is the name of a new hand tool for freeing frozen zirc-type fittings on cars, trucks, tractors, oil rigs, and the like. A pocket-size tool, it is claimed to generate up to 1000-psi hydraulic pressure when its piston is tapped with a 5-lb mechanic's hammer.

Gaskins & Stockman, the manufacturers, state that unless the bushing has been turned so as to completely block the opening, the tool will blow out all hardened grease, dirt, or other foreign matter. They also state that Ram-O may be safely used on angle as well as straight fittings and in many cases its use will automatically reseat damaged fittings.

Operation begins with the tip of the tool being inserted in a can of motor oil. Its piston is pulled back to fill the inner barrel with oil. The tool is then held against the frozen fitting with one hand and the piston head given a sharp blow with the hammer. When the piston goes home, it indicates that the fitting and shaft are clear.



Kahlenberg

TURBOCHARGED DIESELS

Ultramodern in design with high accessibility, high power output, low specific fuel consumption, low noise level, low piston speed, all combined in a new direct drive heavy duty Diesel having welded frame construction and low power-weight ratio.

Sizes to 1100 BHP, 300 to 400 RPM

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Diesel Engines—Airhorns—Propellers—Auxiliaries

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If you want to become a member of DIESEL POWER'S organization . . . if you're interested in earning *hundreds of extra dollars* for just a few spare-time hours . . . then YOU may qualify for one of the 100 lucrative openings as a DIESEL POWER subscription agent.

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DIESEL POWER will supply ALL MATERIAL you'll need to take orders. YOU merely write the orders—AND KEEP 50% *OF THE SUBSCRIPTION FEE.*

For further information and sales material, just fill out the form below.

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I wish to become a DIESEL POWER subscription agent, and to receive a 50% *commission on every new subscription I sell.* Send me the necessary information and sales material.

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A New Concept in

FULL-FLOW Filters...

ENGINE LIFE *Maxiflo*

UNRESTRICTED CORE

DESIGNED TO GIVE MAXIMUM FLOW AND FILTRATION

Conditions oil without restricting flow

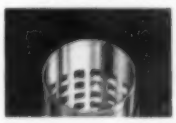
Here's a brand new ENGINE LIFE exclusive that gives unrestricted oil flow without sacrificing strength. This new core development which required research and development of special machines and tooling right in our own plant, gives you the finest full flow oil filtering yet. Now, even the most viscous lubricating oils and fuels are filtered perfectly. Because core openings can handle up to 10 times the oil pumped through the system, the most excessive surges are easily handled, thereby protecting the hydraulic system from undue restriction and ultimate failure. All integral parts of the new Maxiflo core are of non-corrosive metal.

New core perforation, instead of removing metal from openings, keeps all the metal pronged to give element structural strength and prevent filter media from sagging
ENGINE LIFE

With Maxiflo, as in all Engine Life Elements, consistency in diameter and length is maintained

ENGINE LIFE elements operate without impairing the hydraulics of your engine. Better oil conditioning is achieved through the ENGINE LIFE absorption method of full filtration. All ENGINE LIFE elements are engineered to meet requirements of your application.

ENGINEERED FOR ALL REQUIREMENTS



Lubrication system flow rates are maintained by the free area ratio of perforation. Openings equal up to 10 times amount of oil volume pumped through engine.

Non-corrosive Metal Cores are end sealed with metal rings to insure trueness, add lip strength.

ENGINE LIFE *PRODUCTS CORPORATION*

EL MONTE, CALIFORNIA

organizational news

A New Face at Harnischfeger
is that of Charles F. Parthum. Formerly with The Buchen Co., he has joined the organization as advertising and sales promotion manager.

Elevated to Vice President
at Van Norman Automotive Equipment Co., Philip D. Moulton has been with the company since 1929. He was just recently made general sales manager.

Philip D. Moulton

Advertising Manager
is now the title of D. J. Clymer at Detroit Diesel, GM. With the organization since 1943, he was most recently in charge of distributor sales management programs and national trade shows, and also assistant to the advertising manager.

Formation of a New Division
to develop, sell, and manufacture specialized heat transfer products and other assemblies has been announced by Perfex Corp. F. W. Doyle, previously assistant sales manager of the industrial radiator division is now sales manager of the new division. Gene T. Neudeck has joined the organization to take up Mr. Doyle's previous post.

Chief Research Engineer
is the new title of Vern C. Vanderbilt Jr., at Perfect Circle Corp. A former Purdue University professor, he has been serving as research consultant to the firm for the last nine months.

Appointed Sales Manager
at Quincy Compressor Co., is Loren Gillhouse. He assumes his new duties after five years as assistant sales manager.

Loren Gillhouse

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SEND FOR BULLETIN V-10

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organizational news

A Newly Created Position
that of assistant chief engineer, has gone to Norman B. Chew at Freightliner Corp. This engineering expansion is in line with the company's growth in the manufacture of heavy-duty COE diesel trucks for on-highway use.

Now Sales Manager
at Winslow Engineering Co. is John F. Bacher, with the company for the past eight years. Announcement of his appointment highlighted the recent national sales meeting of the company.

John F. Bacher

Dr. Herbert Trotter, Jr.

Engineering and Research
will be the province of Dr. Herbert Trotter, Jr., just appointed vice president of that department at Sharples Corp. Previously associated with Eastman-Kodak Co., he will now be responsible for development of centrifuges and centrifugal processes as well as other projects.

Going to England
as managing director of Allis-Chalmers Great Britain Ltd., the wholly-owned A-C subsidiary, is Myron W. Rhoten. He succeeds E. J. Mercer who has returned to this country as general manager of the company's Construction Machinery Div.

Overseas Appointment
has been given to Robert J. Dawson, former assistant factory manager at Peoria, as manufacturing manager of Caterpillar Tractor Co's new plant in Glasgow, Scotland. Also named for new Scottish posts are Hans G. Frommer as production manager and William I. Cusson as superintendent of assembly. The three will relocate in the new Caterpillar D8 and D4 crawler tractor plant in the late spring.

Named Manager
of the engine and compressor dept. at American Air Filter Co., Inc., George C. Rodgers succeeds the late Charles Sowerby. In addition to his new duties, he'll continue as manager of military products.

George C. Rodgers

new literature

New Filter Housings
designed for fast and easy cartridge changes, developed by Cuno Engineering Corp., are described in Catalog MK-170. Called Series QS, they were made expressly for high-capacity diesel full-flow lube systems. Specifications, flow rates, and engineering drawings are contained.

Waste Heat Evaporators
that transform sea water into fresh water by utilizing waste heat from diesel engines, are covered in a brochure "Fresh Water by the Ton", available from Cleaver-Brooks Co. A comparison chart, showing possible savings over other methods, is included.

ROCKFORD

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Using a new type friction material of recent development, ROCKFORD was the FIRST to engineer these new materials into MORLIFE Clutches and Clutch Plates. They reduce clutch size and engaging pressure, operate longer without adjustment or plate replacement — and avoid down-time caused by burned or warped plates in heavy duty tractors, trucks, tanks, cranes, power units, shovels, bulldozers, earth movers and other heavy duty machines.

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ROCKFORD Clutch Division BORG-WARNER

1301 Eighteenth Avenue, Rockford, Illinois, U.S.A.

CLUTCHES

Dredge Pump Applications
are presented in case history form in a 2-color, 16-page, illustrated booklet from American Brake Shoe Co. Eleven different sand and gravel operations are given.

Dieselect Fuel Oil
a product of Gulf Refining Co., is described in a just published pamphlet. It is claimed to be a specially refined fuel for high-speed engines, completely free of gum-forming and sludge-forming tendencies.

Copper Wire Tables
of value to anyone concerned with the distribution of electrical power, are available in revised edition from the Government Printing Office. In this new edition, which sells for 30¢, the tables have been extended to 50 gauge and up to 200°C. All data is expressed in both English and metric units. A number of very simple formulas for computing data for any wire size is included.

Centrifugation Problems
are discussed in a bulletin distributed by Centrico Inc. Specific types of separators are recommended for each application of centrifuging: clarification, separation, and concentration.

How to Soak Away Lime Scale
and rust, is told in a folder offered by Oakite Products, Inc. It describes the action of Compound No. 32, an inhibited liquid descalant which is said to eliminate mechanical scraping or rodding out. Specific instructions are presented.

Pneumatic Equipment Users
will be interested in a booklet listing all JIC symbols for pneumatic valve controls along with a drafting template guide. The 40-page booklet contains simplified drawings which may be used to designate any manufacturer's equipment. Quick drafting aid of desired symbols is offered by the template guide. Ross Operating Valve Co. makes the combination available for $1.

new literature

Industrial Brushes
are the subject of a technical reference manual published by the Pure Carbon Co. Included are methods of manufacture, grade descriptions, a table of average characteristics, and application information and recommendations.

Grinding Diesel Crankshafts
which are extra long and heavy with speed and accuracy is a precision job. Van Norman Co. has engineered its new patented load compensator for this close tolerance work and has issued literature containing full information on the device. Feature details, working diagrams, and complete specifications are included.

Casting Aluminum
is the newest addition to the technical library available from Reynolds Metals Co. to help the designer select the casting process and aluminum alloy best suited for his requirements. It is a 130-page, 6- by 9-in handbook, ring bound to lie flat when open.

The Right Electrical Tape
for every insulating and protecting application, is the information supplied by a 12-page booklet issued by Johns-Manville. Illustrations, technical data, characteristics, and performance specifications for each type are provided.

Fuel Injection Equipment
manufacturing practices at Caterpillar Tractor Co. are discussed in "Something Special", an 8-pager available in four languages.

What Grade of Oil Do You Need?
The American Petroleum Institute has just released a booklet explaining in simple language its recently revised engine service classification system which provides a working guide for choosing crankcase oils under varying service conditions. Copies are available at 15¢ each.

Earthmoving and Construction
machinery, manufactured by Allis-Chalmers, are reviewed in a pocket-size booklet. It presents the complete line, with matched equipment, pictorially and with brief descriptions for a minimum of reading time.

How Zinc Controls Corrosion
to lengthen life and minimize maintenance and replacement costs, is the evidence supplied in a 16-mm color film produced by The American Zinc Institute. Booking forms are available.

Better Handling Methods
including cost-cutting tips are featured in the latest issue of "Handling Materials Illustrated", Towmotor Corp.'s house organ.

Test Specifications
for all active models of batteries, coils, distributors, generators, cranking motors, regulators, and magnetic or solenoid switches, manufactured by Delco-Remy, have been put in booklet form. It lists at 25¢ each, with a special price for quantity order.

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ILLINOIS TESTING LABORATORIES, INC.
Room 507, 420 N. La Salle St., Chicago 10, Illinois

news of our industry

GE to Build Export Diesels

General Electric Co. has announced a universal line of nine diesel-electric locomotives, so-called because they "can be used on almost any railroad in the world."

Any of the nine will be capable of switching, freight, or passenger service, it is stated, and can be built for a wide variety of gauges. They can also be adapted to all types of couplings and braking systems and are proportioned to meet restricted clearances encountered abroad.

Five hp sizes are available: 400, 600, 990, 1320, and 1980 to produce maximum speeds ranging from 60 to 90 mph, and continuous tractive efforts from 26,500 lb to 53,000 lb.

The locomotives have a floating bolster suspension system which employs a truck bolster mounted on rubber pads to permit lateral motion. With this, they say, the locomotive will receive less jar and strain. Minimum stress as well will be placed on tracks and structures.

Highway Transit Forecasts

Better lighting, puncture-proof tires, fool-proof brakes, and television viewing of side and rear scene by drivers are some of the improvements predicted for the trucking industry by B. M. Seymour, president of Associated Transport, Inc. Other developments that will be commonplace in 1975, he stated, will be plastics, lightweight metals of great durability, and gas-turbine-type engines.

Power Show for New York City

For the first time since 1952, the city of New York will be the site of a power show. It is scheduled for the new Coliseum, a large and modern exhibition center, just recently completed. The show, entitled the 22nd National Exposition of Power and Mechanical Engineering, will be conducted under the auspices of the American Society of Mechanical Engineers. Dates are Nov. 26-30. Program of events has not as yet been announced.

Venn-Severin Back in Business

An old name in the diesel field, Venn-Severin Engine Works, Inc., has returned to the industry with a redesigned engine series. Called the 308, they are 2-cycle engines of the vee type. Two basic models are currently available, the V-6 and V-4.

Of 7-in bore and 8-in stroke, respectively, their maximum ratings at 1000 rpm are 320 hp for the V-6 and 210 hp for the V-4. Total displacements are 1849 cu in and 1233 cu in. Their injection systems employ the American Bosch fuel pump. Air scavenging is accomplished by two Roots-type blowers. Starting systems offer option of electric, compressed air, or hydraulic. For stationary and marine installations, there are six electric generating model selections.

RRs Up Diesel Fuel Purchases

Excluding equipment, Class I railroads spent $1,637,075,000 for fuel, materials, and supplies in 1955. This represents an increase of $212,314,000 in the 1954 figure, according to a recent report by the Assn. of American Railroads.

Compared with $433,310,000 spent for fuel in 1954, railroads invested $453,852,000 in 1955. Expenditures for coal decreased to $76,731,000 in 1955, compared to $81,013,000 the previous year. Diesel fuel payments totaled $331,766,000, an increase of $23,994,000 from 1954.

Cummins to Hike Production

An additional 17% increase in its production rate has been announced by Cummins Engine Co., Inc., over and above the 21% increase declared in January. This new production rate, R. E. Huthsteiner, president, discloses, "will be the highest in the company's 37-year history."

In line with the production stepup, a $6 million capital program for this year is reported. It will include construction of a 73,000-sq ft addition to the manufacturing plant. Upon completion of this program, Cummins will have spent $17.3 million on capital additions since 1951 when its first major plant expansion program was initiated.

Photo, courtesy Kahlenberg Bros. Co., Two Rivers, Wisc.

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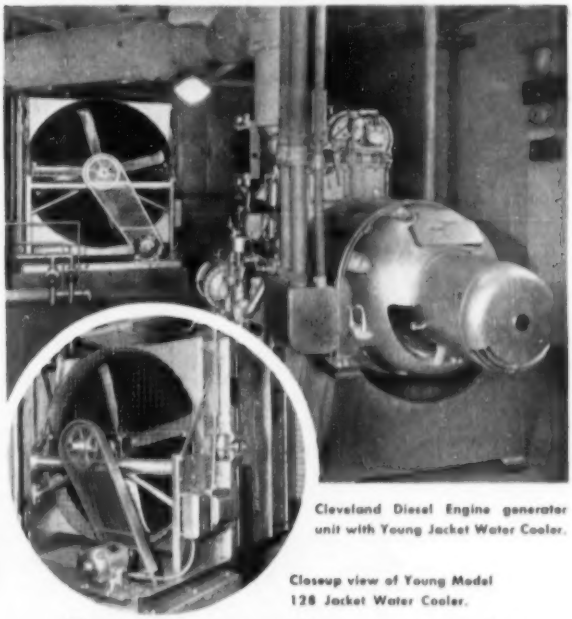

Cleveland Diesel Engine generator unit with Young Jacket Water Cooler.

Closeup view of Young Model 128 Jacket Water Cooler.

Emergency Power Unit Cooled by Young Radiators

Take positive and dependable steps to prevent shutdown or impairment of telephone service when outside power sources are disabled or unavailable . . . this was the edict of the Wisconsin Bell Telephone Company. At Racine this challenge was met with the installation of an emergency power unit, a Cleveland Diesel Engine Division (General Motors Corporation) Model 4-268A engine. THIS ENGINE IS COOLED BY A YOUNG JACKET WATER COOLER. This radiator is used both to cool the engine jacket water and to provide suitably cooled water for use in the lube oil cooler of the engine. Another example of Young quality products entrusted with a job where absolute dependability is essential.

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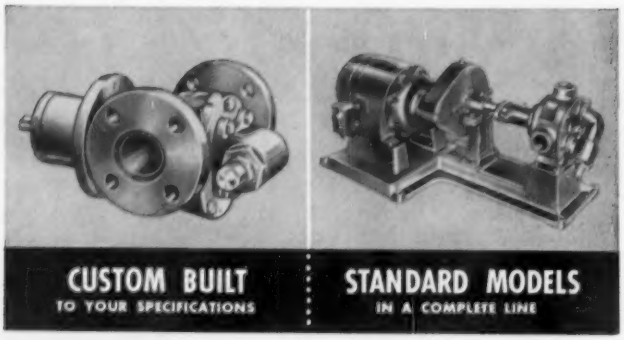

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news of our industry

GM Opens New Technical Center

Completion of a 330-acre, 25-building site at Warren, Mich., will be officially commemorated by a special program of tribute and open house ceremonies in GM plants throughout the country, May 15-16. Harlow W. Curtice, president of the corporation, described the new technical site as a "great milestone in the country's modern industrial history."

The center will be the home of four GM staff organizations: research, engineering, styling, and process development. First public announcement of the new facility was made July 1945 and excavations for the first building groups on the site were begun July 1949. The completed 25 buildings in the group range from gatehouses to offices, shops, studios, and laboratories. Together they are said to represent the best equipped scientific and industrial laboratory in the transportation industry.

Alco to Plate in Canada

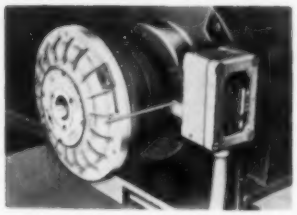
Acquisition of exclusive rights in Canada for the Kanigen electroless nickel-plating process has been announced by Alco Products, Inc. This process, developed by General American Transportation Corp., is established in the U. S. by Alco as Alcoplate.

The Canadian rights authorize Alco either to install plating facilities in that country or to sub-license the process to Canadian manufacturers. Both possibilities are presently being investigated. The process itself will be marketed under the Kanigen trademark.

FPC Okays Compressor Station

A certificate has been issued to Transcontinental Gas Pipe Line Corp. by the Federal Power Comm., authorizing it to construct a 4000-hp compressor station on its natural gas pipeline system in Evangeline Parish, La. Estimated to cost $841,000, the station will be located on the site of an existing compressor station.

new literature



Flexidyne Development

Dodge Mfg. Corp. has just announced a thermal cutout for its Flexidyne dry fluid drive, to protect against overheating. With this device, the company states, thermal protection is now added to the mechanical overload protection inherent in the Flexidyne. The result is that if an overload causes prolonged slipping and consequent heating of the Flexidyne, the thermal cutout trips a switch to cut off power and, if desired, actuate an alarm.

The unit is recommended especially for all unattended installations. It mounts on the side of the Flexidyne. A trigger spring is contained, held down by an alloy thermal pin. This thermal pin melts before the Flexidyne can heat up enough to cause damage, to allow the trigger to spring out. The released trigger pushes a special switch, which then cuts off power. Resetting is accomplished by pushing back the trigger and inserting a new thermal pin.

New Asbestos Fabric

Oil-cooled power transmission equipment users and designers will be interested in a new series of friction materials of woven asbestos fiber developed by Thermoid Co. engineers. The material contains no metallic particles or wires and is said to be lighter and less expensive than metallic friction discs for this type of application.

Because it is claimed to give results comparable to other types of friction materials, the fiber is claimed to be capable of use in existing units without changing design, and in new designs with normal considerations. It is designed to be bonded to metal plates with thermosetting resins and assembled with metal pressure plates. Action of oil-cooled units using the new material is said to be smoother because of its cushioning effect. Its pores are stated to serve the same function as grooves ordinarily required in friction materials.

Air Exhaust Muffler

Noise reduction of 75% throughout its No. 2 series of air-driven tools has been accomplished by use of a newly developed exhaust muffler, Thor Power Tool Co. declares.

The muffler, "Silentair", is a steel sleeve having 24 perforations. This is claimed to provide a large expansion chamber for exhaust air before it reaches the outside atmosphere. Coupled with an internal 3-stage muffling system, the sleeve and its acoustical pattern of holes is said to break up and absorb the air motor's sound. Service facilities have been set up to install the sleeve on screwdrivers and nutsetters now in use.

J. A. Hill, vice president of the company states: "Our engineers have made thorough decibel chartings and state that both magnitude and pitch of the air waves are sharply reduced." Compared to the high-pitched howl of non-muffled air tools, he adds, the net result is a middle-level hum.

Nylon Plastic Fittings

Numerous advantages such as light weight, low cost, and resistance to attack by most acids and alkalies, are claimed for a new line of fittings under production by Thomas Associates. For use with either metal or plastic tubing, the fittings are molded from nylon plastic and are two-pieced. The material is said to eliminate galvanic action to permit the joining of brass, aluminum, copper, and steel.

Units are offered in a complete line of shapes and in sizes from $\frac{1}{8}$- to $\frac{1}{2}$-in tube and pipe, interchangeable with comparable JIC. Temperature range is from —70°F to 295°F to permit steam cleanings. An emphasized feature is that the nut has a molded integral ferrule which compresses against the tube to form a flareless vibration- and leak-proof seal up to 500 psi.

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organizational news

Correction Please!

The March issue of this publication carried an erroneous announcement of organizational changes at The Waukesha Motor Co. Recent staff promotions occurring there have placed three men in executive positions. C. K. Jones is now assistant manager of purchases. In the railway division, Melvin C. Erickson now occupies the post of chief engineer, with Paul W. Mantz in the capacity of assistant sales and service manager for the same division.

A New Sales Office

for Roots-Connersville Blower has been established in Pittsburgh. Edward N. Bonnett has been named to head the office; sales territory to include western Pa. and the northern counties of W. Va.

Advancements at American Bosch

have occurred in three top posts. Sidney E. Miller, former engineering vice president, is now filling the position of vice president and general manager at the company's Springfield Div. Harold R. Sennstrom, formerly product development vice president, has taken over Mr. Miller's previous post. Kenneth F. Leaman has become assistant general manager as well as manufacturing vice president.

S. E. Miller

H. R. Sennstrom

K. F. Leaman

H. E. Bollwinkel C. R. Boll R. B. Stoner

Three New Board Members

have been chosen at Cummins Engine Co., Inc. In recognition of his importance in the organizational setup, H. E. Bollwinkel has been promoted from executive service manager to vice president—service. C. R. Boll, vice president—sales, and R. B. Stoner, vice president—personnel, are now part of the 14-member board.

Back in the Field Again

is Bert Royce, who in the early part of the century introduced the mechanical ditcher to contractors throughout the U. S. Starting his 46th year with Gar-Wood-Buckeye, Mr. Royce will be operating in the South and Southwestern areas.

Two New Vice Presidents

have been elected by the board of Worthington Corp. They are A. William Fraser, in charge of midwest region sales, and Clarence S. Wentworth, sales manager of the central region.

Elected President

and general manager of Marion Power Shovel Co. and its subsidiary, The Osgood Co., Milton T. Smith, brings a background of more than 27 years of service in the industry to his post.

Upgraded to General Manager

of sales for Stratoflex, Inc., C. A. Thomas will continue to headquarter in Fort Worth where he was previously sales engineer. He's been with the company since 1950.

The Promotion

of H. S. Vierling to assistant general manager and superintendent of transportation was announced by C. M. Roddwig, Chicago and Eastern Illinois Railroad president. Holding the office of superintendent of transportation since May 1954, Mr. Vierling's newly created post will continue him at the C. & E. I. headquarters in Chicago.

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What Do You Know!

(*Answers to Questions on Page 67*)

1. Correct answer is "a". Certain applications demand that the output shaft speed remain constant even though the load varies and the engine may be speeded up to put out more horsepower as required. See article on Page 74.

2. Correct answer is "b". Experience has shown that although the peak load of most municipal power plants does not quite double itself in ten years, the total capacity generated will. See Page 68.

3. Correct answer is "c". A run-away engine will result if preservative oil is put into the intake system with the engine running. See article on Page 65.

4. Correct answer is "b". If possible, turn engine occasionally by hand one or two turns about once a month to prevent seizure of water pump seals. Add preservative to each cylinder after turning if oil is of type that scrapes off. See above article.

5. Correct answer is "a". During normal operation, residues of combustion products accumulate in the combustion area and in lube oil, combining with atmospheric moisture to form corrosive compounds. These are the things that do the damage if engine isn't protected during storage. See article on Page 65.

6. Correct answer is "a". Tests performed by various engine cooling fan manufacturers show that in certain vehicular diesel engine operation the fan is needed only about 5 to 8% of the time. See article on Page 56.

7. Correct answer is "b". Tests performed by engine cooling fan manufacturers in conjunction with truck owners show that from 3 to 10% less fuel is used when fans are used only part time. See Page 56.

new products

Combustible Gas Indicators

To meet industrial need for detecting and measuring flammable gases and vapors, Mine Safety Appliances Co. has come out with a line of portable instruments which weigh 6 lb and operate on dry-cell flashlight batteries. Four models, each intended for specific functions, are in the line, all the same size and each using standard detector and replaceable compensator filament units.

Samples of atmosphere to be analyzed are drawn into the instrument by squeezing an aspirator bulb. Combustibility test is made by a balanced Wheatstone Bridge circuit, supplied with current by the batteries which provide 10 to 11 hours of continuous service. A test is said to be accomplished in seconds.

The Wheatstone Bridge circuit consists of two platinum wire filaments heated to relatively low temperature. One filament is exposed to the atmospheric sample and the other is housed in a sealed chamber as reference. The instrument indicating meter is flush-mounted and uses a core magnet movement to prevent interference from magnetic fields that may be encountered in manholes and electric utility vaults.

Model 30 indicator, developed for utilities and municipalities, is capable of differentiating between natural gas and petroleum vapors. It normally operates with the detector filament hot enough to burn natural gas and other combustibles. A selector switch is included to adjust the filament temperature to indicate presence of low ignition temperatures like petroleum vapors.

Oil Leak Seal

Lake Chemical Co. announces an improved version of its Oyltite-Stik for sealing oil leaks under great pressure and temperature. This new formulation is said to have proved satisfactory for use on hot oil pipes where pressures up to 75 psi and temperatures to 400°F were encountered.

Such faults as cracks, pinholes, rusty parts in welds, are said to be sealable. The product is in stick form and is applied by rubbing across the leaky area. It can also be applied while oil is flowing, it is stated, so that there is no need to drain tanks or pipes. It is said to be suitable for use with fuel, lubricating, vegetable, or tar oils and gasoline.

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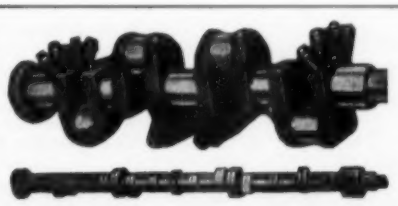

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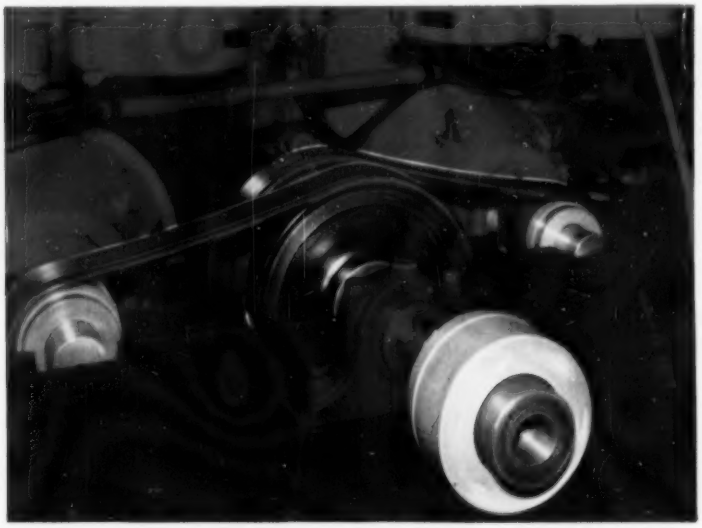
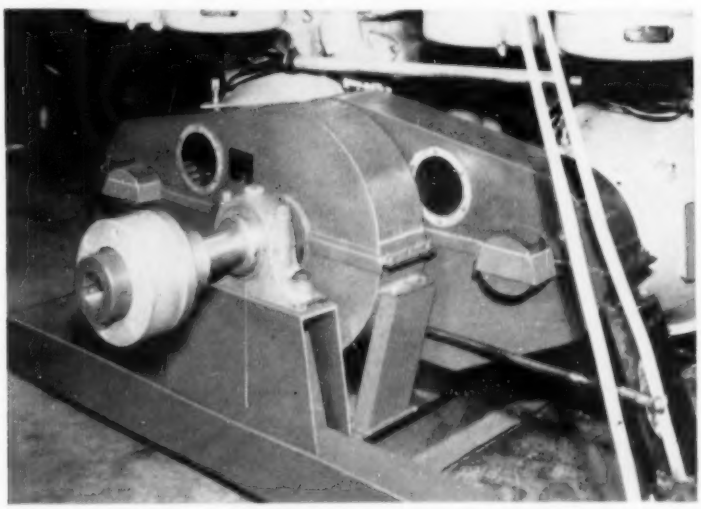


Note the smooth action of Morse HY-VO in operation. Matched 182-HP diesel engines, operating at 1450 RPM, are twinned through HY-VO Drives to jack shaft, which operates at 650 RPM. Jack shaft delivers 364 HP to load shaft (not shown), to which it is coupled with Morse Morflex Radial Coupling (see below).



Twin HY-VO Drives are encased in sealed casings, permit continuous forced-spray and sump oil lubrication. Observation ports permit inspection. Morflex Radial Coupling cushions any shock loads from driven unit, prevents engine pulsations from entering driven shaft.

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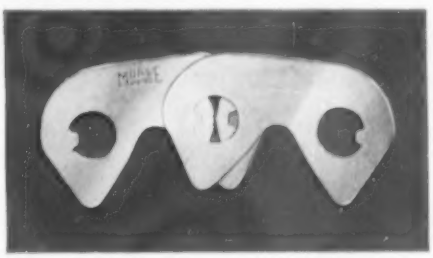

HY-VO Drive links, showing exclusive rocker-type joint. Rocker joint reduces wear and friction, results in coolest running chain drive.

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